PHILIPPINE
BUREAU
OF
SCIENCE
REPORTS
5-11
1906-12

Q
183
.P55

UNIV.
OF
MICH.

EIGHTH ANNUAL REPORT

OF

THE BUREAU OF SCIENCE

TO THE HONORABLE
THE SECRETARY OF THE INTERIOR

BY

RICHARD P. STRONG

FOR THE YEAR ENDING AUGUST 1, 1909

MANILA
BUREAU OF PRINTING
1910

92292

EIGHTH ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF SCIENCE.

DEPARTMENT OF THE INTERIOR,
BUREAU OF SCIENCE,
Manila, August 10, 1909.

SIR: I have the honor to present a brief report of the work performed in the Bureau of Science from August 1, 1908, to August 1, 1909. The different divisions of the work have been discussed as briefly as seemed practicable, and recommendations covering future improvements either have been merely mentioned or entirely eliminated. In order to avoid repetition miscellaneous questions which relate to the Bureau will not be treated separately but will be considered under the discussion of that division of the Bureau to which they chiefly refer. The Director of the Bureau left Manila on his vacation on April 10, and since that date the Chief of the Biological Laboratory has assumed, in addition to his own duties, those of the Director of the Bureau.

THE BIOLOGICAL LABORATORY.

MEDICAL SECTION.

THE STAFF.

A few changes in the personnel of the laboratory have occurred during the year. Dr. Oscar Teague, formerly assistant in experimental pathology at Cornell Medical College, New York, was appointed to fill the vacancy caused by Doctor Marshall's resignation, the latter having accepted a call to the chair of pathology in the University of Virginia. The laboratory deeply regrets the loss of Doctor Marshall's services. Dr. Arthur F. Coca, assistant in the Cancer Institute, Heidelberg, and Dr. Vernon L. Andrews, of Johns Hopkins University, were also appointed to other vacancies on the staff. In January, Surgeon-Major Erich Martini, of the German Navy, who had secured leave of absence from his duties in Tsingtau, China, was detailed for the purpose of making a special investigation relating to the infectious diseases of cattle in these Islands. Professor Martini was formerly assistant to Professor Koch in the Institute for Infectious Diseases in Berlin, and has had a wide experience in relation to studies of this nature; the laboratory was fortunate in securing his services. He pursued his investigations here until June, but was unable to obtain further leave from his station in China after July 10. An attempt is being made to secure the services of Prof. W. Kolle, director of the Swiss Serum Institute in Bern, for the purpose of continuing this special study of the infectious diseases of animals. Professor Kolle has had very extensive experience in South Africa with cattle diseases and it is practically his method of immunization against rinderpest that is employed in these Islands. It is earnestly hoped that the laboratory will be successful in securing his services. Capt. E. R. Whitmore, Medical Corps, United States Army, was detailed for special investigation in the laboratory on November 2, and has since pursued his studies here. Dr. Liborio Gomez, a Filipino graduate of Chicago University and The Rush Medical College, was appointed as a temporary employee on the staff October 16, and Doctor Sellards, of Johns Hopkins University, to a permanent position on the staff August 9. Two members of the staff have been sick for several months during the year, which has interfered considerably with some of the experimental work of the laboratory. Dr. W. E. Musgrave was sent by the Government as a delegate from the Philippine Islands to the Bombay Medical Congress in January, and reported upon the subject of streptothricosis. He returned to Manila in March. This Bureau hopes during the coming year, at the meeting of the Far Eastern Association of Tropical Medicine in February, to be able to extend in return to the Indian physicians some of the courtesies and attentions shown by them to Doctor Musgrave during his visit in Bombay. Doctor Garrison, United States Navy Department, who has been on duty as medical zoölogist since January 10, 1907, will be relieved from his detail at the laboratory on August 15 of the fiscal year 1910. Doctor Garrison's services have been very valuable to the Bureau and his departure is exceedingly regretted.

The position of medical zoölogist in the laboratory, while a very important one and offering excellent opportunities for original investigation, probably will not be filled quickly. The supply of competent medical zoölogists in the United States does not equal the demand; an effort was made during the year to secure Dr. Charles Wardell Stiles, chief of the division of zoölogy in the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service, but his services could not be spared from Washington. The services of both a helminthologist and a protozoögist will be greatly needed in the laboratory as well as in the Medical School during the coming year, and it is important that satisfactory and permanent appointments be secured for these positions; in these Islands the fields of helminthology and of protozoölogy are particularly important, and offer unusual opportunities for original investigation.

SECURING OF TRAINED MEN FOR THE LABORATORY.

The laboratory is no longer experiencing the same difficulty as it did in previous years in securing younger men from America with excellent training to fill vacancies. The obvious reason for this change is that scientific workers have become more familiar with the work of the laboratory and the results obtained by it. Obviously for the majority of the positions in the laboratory, where special training is required, as for example in tropical medicine, bacteriology, zoölogy, entomology and botany, in the production of serums, etc., it is still necessary to train men after they have arrived in the Islands. The hope has been expressed that assistants in the laboratory might be obtained through the further training of Filipino graduates of the medical schools of the United States and of our own graduates of the Philippine Medical School. Up to the present time, however, but little has been realized in this respect, although it is thoroughly believed that more desirable candidates will be found in the future. Some of these graduates from America who have been specially trained in laboratory work have shown no inclination to continue their studies in this direction in the Philippine Islands; and so far, the chief desire of the Filipino graduates, not only of the medical schools of the United States, but also of our own school in Manila, has been to enter at once into the private practice of medicine. I have been informed by a Filipino graduate recently from the United States that one reason for the desire of some of the returning students to begin private practice is that they have acquired expensive methods of living while in the United States, and that unless they possess independent means they find upon their return to the Philippines that they require more money for their living expenses than the Government will offer them for their services. Of the eight students composing the graduating class of our own medical school for the present year, only two accepted internships established by the Government in the hospital and providing board and lodging and 30 pesos ($15, United States currency), per month salary. The remaining six preferred to enter into private practice. It is only fair to state that these graduates entered the medical school as fourth-year students, and perhaps better results will be obtained from those students who have attended the entire five-year course of the school. It, however, will probably be many years before the more responsible positions in the laboratory can be satisfactorily filled in this manner. Several minor positions in the chemical laboratory have been filled satisfactorily by Filipino graduates of American universities, and as far as capability is concerned there is no reason why corresponding positions in the biological laboratory should not be filled by Filipino graduates.

RELATION OF THE STAFF OF THE BIOLOGICAL LABORATORY TO THE STAFF OF THE PHILIPPINE MEDICAL SCHOOL AND THE NEW HOSPITAL.

During the year considerable time has been devoted to teaching in the Philippine Medical School by several of the members of the laboratory staff; this was necessary on account of an insufficient number of instructors in the latter institution. The organization of the department of tropical medicine in the school, the general supervision of the courses and the actual teaching of this subject have consumed considerable of the time of the Chief of the Biological Laboratory. Doctor Musgrave and Doctor Andrews, of the laboratory staff, have also held the positions of professor of clinical medicine and assistant professor of pathology, respectively, in the school. The character of their work in the school has been such as to occupy the greater portion of their time, and the laboratory has thus lost largely their valuable services. Doctor Garrison and Doctor Ruediger, of the staff, also have been engaged in teaching during the year, the former in medical zoölogy and the latter in bacteriology. Mr. Banks of the entomological section has also given the course in medical entomology. The Medical School work of these gentlemen has not, however, interferred to any great extent with their laboratory duties. The question of the regulation of a number of these positions in the laboratory and the Medical School is one of great importance. It is not deemed advisable to enter into a more lengthy discussion of the matter at the present time, as it will be made the subject of a special report to the Honorable, the Secretary of the Interior.

The suggestion has been made in connection with the work of the laboratory, the Medical School, and the new hospital, that a separation should be made between the investigation carried on at the bedside of the patient in the hospital and that carried on in the laboratory and that each line of work be assigned to different men. Such a step, in my opinion, would be most detrimental to the advancement of tropical medicine in these Islands. For several years it has been the hope of the Director of the Biological Laboratory that a hospital would be established in connection with the laboratory, and that a certain number of the staff of the laboratory should have assigned to them the care of the patients in the wards set aside for infectious diseases; such an arrangement is pursued in many institutions in Europe, and has been recently adopted at the Rockfeller Institute in New York; also, in both the Institute for Infectious Diseases in Berlin and the Pasteur Institute of Paris this arrangement is carried out. Certain problems relating to the advancement of our knowledge of human diseases in the Philippine Islands may be investigated almost entirely in the laboratory, but the great majority of them require both laboratory and clinical observation. In my opinion the most ideal arrangement that can be made for the study of the etiology and treatment of infectious diseases is that the assistant carrying on in the laboratory investigations relating to such diseases also should have under his daily observation in a hospital ward patients afflicted with the same disease. The duties of at least two of the members of the present laboratory staff should be arranged in such a manner that they will have hospital as well as laboratory work in tropical medicine, while the remainder of the staff should devote themselves to purely laboratory subjects. On the other hand, the position controlling the teaching of the branches of clinical medicine and the wards devoted to the general and systematic diseases relates rather to the Medical School than to the laboratory, and whoever ocupies this position must spend most of his time in the hospital and less in the laboratory. In my opinion, a mistake has been made in the past in that a certain number of the staff of the laboratory has not been kept in sufficiently close touch with the patients suffering with tropical infectious diseases in the hospital. Since the beginning of the year the Chief of the Biological Laboratory has had hospital wards at his disposal, in connection with the work in tropical medicine at the medical school, and the opportunities which have been offered to the laboratory for research thereby have thoroughly demonstrated the importance of a close connection between the laboratory and the hospital work. There can be no question of the advisability of the biological laboratory having wards in the hospital at its disposition for the reception of patients suffering with infectious diseases.

SCIENTIFIC VISITORS.

The number of scientific visitors to the laboratory has increased each year. Partially through them, the opportunity which the laboratory furnishes to investigators, with its thoroughly modern equipment, its extensive library, and its facilities at hand for study, are becoming more widely known. Professor Fülleborn, of the Hamburg School of Tropical Medicine, who recently visited here, has expressed the opinion that the laboratory furnishes better opportunities for the study of tropical medicine than any institution he is familiar with.

INVESTIGATION OF ANIMAL DISEASES.

For the last half of the year the entire time of Doctor Martini has been devoted to the subject of diseases in cattle. A study has been made of a form of piroplasmosis affecting calves in the Philippine Islands. The piroplasma did not apparently render ill the animals which were infected with it. This parasite is probably identical with the one of Texas fever, described from this laboratory in 1904 by Jobling and Wooley, who reported Texas fever as endemic in the Islands. In the blood of a calf infected with this piroplasma, Doctor Martini also demonstrated by cultivation a trypanosoma. He therefore attempted to repeat the experiments of Miyajima, carried on in Japan, which seemed to show that the trypanosoma represented a stage in the life cycle of the piroplasma. However, Doctor Martini found that this could not be demonstrated in the case of the Manila piroplasma and that the trypanosoma bore no relation to the piroplasma, but that the calf was infected with two distinct parasites. From the fact that the trypanosoma encountered was found to be very scanty in the blood of the animals infected with it, that it could be cultivated in artificial media (defibrinated blood and bouillon), that monkeys could not be infected with it, and that it showed peculiarities in morphology, it was concluded that it was probably a new trypanosoma. One might explain the changes in morphology as due to the cultivation of the organism in artificial media. If the parasite should prove to be really *Trypanosoma evansi* it must represent a very much attenuated strain of this organism and one with which we have not hitherto been familiar. It is unfortunate that Doctor Martini before leaving destroyed the animals infected with this strain of trypanosoma, as it might possibly have proved of value in immunizing horses against trypanosomiasis.

Surra.—During the past few months extensive experiments have been carried on by Doctor Teague and the Chief of the laboratory in the treatment of trypanosomiasis. In this work we have had the advice of Professor Ehrlich, director of the Laboratory for Experimental Therapy in Frankfurt, who has kindly sent us the latest preparations from his laboratory which were hoped would be most efficacious in combating trypanosomiasis. While it is too early to speak with any degree of certainty, we have obtained far better results in the treatment of this disease than we have ever done before, and the work at least appears encouraging for the ultimate discovery of a remedy which will at least save a certain proportion of animals affected with trypanosomiasis.

Hydrophobia.—On several occasions during the past year, dogs supposedly suffering from rabies have bitten people in Manila; these animals have been brought to the laboratory a short time after the accident and have been subjected to careful examination. Studies of the brain and cord have been made and Negri's bodies searched for; animal inoculations have also been performed. In all of these instances the results have been negative for rabies. In a single instance the dog was evidently suffering from an infectious disease which somewhat resembled rabies, but which could be transmitted to rabbits and guinea pigs by subcutaneous inoculations of the heart's blood. Negri's bodies were not present. The study of the nature of this disease is being pursued at the present time. The presence of rabies has frequently been reported from the provinces of these Islands, and occasionally even from Manila, and it would seem not unlikely that cases will eventually be discovered by the laboratory in this city. The disease, however, is at least very uncommon here. In four of the cases recently bitten by supposedly mad dogs, the histories of the patients were carefully followed; the wound of one of them was slightly cauterized; in the case of the other three no cauterization was performed, but the wounds were merely washed and bandaged; no symptoms of hydrophobia have developed, although several months have elapsed. The laboratory is not at present preparing virus for inoculating against rabies, and until a genuine case of rabies is discovered by the laboratory in Manila it is not considered advisable to undertake such preparation; its manufacture would constitute an additional expense and would require constant attention.

THE STUDY OF DISEASES IN THE PROVINCES.

Investigations in Taytay.—The policy of the laboratory which has been carried on for several years past, of sending men to the provinces when opportunity presented itself for the study of disease, has been pursued with profitable results during the present year. The most extensive survey of this nature which was carried out was undertaken in the village of Taytay, Province of Rizal. The work was performed by members of the staff of the Bureau and Medical School, assisted by several of the students of the Medical School and by Doctor Clements of the Bureau of Health. The object of this expedition was to make a complete study of a native town in the Philippine Islands under normal conditions. The town of Taytay was chosen because of its size (it has a population of 6,000) and because in the past it has suffered severely from epidemic diseases. If a larger town had been chosen it obviously would have been impracticable to have made as complete a study of the inhabitants. The idea of the expedition was not only to observe how much sickness was present but to examine into the character of the population, the conditions under which they lived, the food which they ate, and the diseases to which they were liable to be exposed. Following out this idea, a geological study has been made of the contour and formation of the country; the water supply has been examined into, and a chemical and bacteriological examination performed of the well waters of the town used for drinking purposes. A botanical examination of the vegetable food-stuffs and general examination of all food-stuffs offered for sale in the markets has been carried on. The cost, quality, and nutritive diet of the people has been studied from a physiological standpoint; and an entomological study of the mosquitoes and other insects found in the town was accomplished. As regards the inhabitants, anthropometric measurements were performed, and in the case of those who visited the station, and particularly in those who were found at all sick or abnormal, a medical history was taken and a physical examination performed; the sputum, blood and fæces were also examined microscopically. In many cases where the nature of the case warranted, serum reactions, differential blood counts, and an examination of the urine were made.

Only a few of the conclusions reached can be mentioned in this report owing to lack of space. As might have been expected, the inhabitants in building their homes in the lowlands considered chiefly the convenience of location in pursuing the agricultural and fishing industries, thus sacrificing the advantages of a healthy location on the hill lands at the east of the town. The water supply of the town is largely from wells which are generally exposed to surface contamination and to contamination from the hands and feet of those drawing water. A bacteriological examination of these wells (13 in number) showed in six over 5,000 microörganisms per cubic centimeter. *Bacilus coli communis* was isolated from seven, and *Bacillus pyocyaneus* from three. Amœbae were found in all but one, and flagellates in all. However, since the general water supply of Manila also usually contains amœbæ, the discovery of the presence of protozoa in the water of the wells was what might have been expected. The natives of the town, of course, drink the water unboiled. Fortunately, the geological structure is favorable to drilling; it is possible that in the southwest part of the town sufficient hydrostatic head might be encountered to produce an artesian flow; and it is recommended that a deep well be drilled at this place with the hope of obtaining artesian water. In case artesian water is not obtained the remaining wells which might be drilled in the town should be made only sufficiently deep to prevent surface filtration. The food of the inhabitants was found to be of limited variety and almost entirely of local production; some dry fish is imported from Manila. The staple diet consisted largely of fish and rice, with some fruits and occasionally carabao milk, eggs, and poultry. From a physiological standpoint the diet of the average person represented 90 grams of protein and 2,700 calories, and for a laboring man 100 grams of protein and 3,100 calories. Practically all of the rice used in the town belonged to the class of "cured" rice, which, it is claimed by the adherents of the rice theory in relation to the etiology of beriberi, never causes this disease, even when it forms the greater portion of the nutriment consumed over a long period of time. In this connection it is interesting to note that no cases of acute beriberi were discovered in the town. The cost of the food consumed by the inhabitants was between 9 and 16 centavos daily, with an average of 12½ centavos (6 cents, United States currency) per person. In relation to the entomological study of the town, two new species of mosquitoes were met with, both belonging to the genus *Culex*. Mosquitoes of the subfamily *Anophelinæ* (*Myzomya rossii* Giles) were found breeding, particularly in the districts of the town along the banks of streams and were not encountered in the central portion of the town. It is interesting to note that the distribution of the *Anophelinæ* as found by the entomologist corresponded very well with the districts in which the cases of malaria were discovered by the clinicians.

Infections with animal parasites.—In an examination of 1,000 persons in the town, no evidence was found of infection with cestodes or trematodes. An attempt to discover any localization of the cases infected with ascaris, hookworms, trichuris, strongyloides, oxuris, or amœbæ, in any part of the town in proximity to certain wells or streams, by families or occupations, gave negative results. It was perhaps surprising that only 2.7 per cent of the persons examined were found to be harboring amœbæ, since 23 per cent of the Bilibid prisoners had previously been found to have these parasites in their stools; however, these examinations at Taytay were performed with very great care. In 11 patients it was thought that encysted forms of amœbæ were observed, but absolutely no reliance can be placed upon the observations of the stools relating to encysted forms of these parasites. Only in case of cultures of amœbæ can one be certain of recognizing encysted forms. The 27 infections discovered with amœbæ were evenly divided between the two sexes and showed no remarkable excessive frequency in any single age group. Eleven and six-tenths per cent of those examined were found to harbor the hookworm, and none of them presented any symptoms of disease which could be definitely attributed to this parasite; 82.9 per cent were found to harbor ascaris and about 77 per cent trichuris.

Other diseases.—Two and two-tenths per cent of those examined were found harboring the malarial parasite, and 0.5 per cent filaria. About 1 per cent was found to be affected with tuberculosis. No focus of this disease was discovered, the cases being distributed evenly throughout the town. Four cases of typhoid fever occurred during the three months the examinations were carried on. Nine cases of cholera also occurred during this time. The stools of 80 individuals who had been in contact with cholera cases were examined for the cholera spirillum, but in no case was this organism found. In this connection it is interesting to note that all of the nine cases of cholera occurred within a period of ten days and during the middle of the hot and dry season. Perhaps for this latter reason no widespread epidemic occurred and no "cholera carriers" were discovered. Eleven cases of goitre were observed. As Taytay is situated in a non-Cretaceous soil, these cases of goitre could not be associated etiologically with an excess of lime salts in the drinking water.

Investigations in the Gandara Valley.—In June Doctor Garrison was sent to the Gandara Valley, Samar, for the purpose of investigating the occurrence of paragonimiasis in this region. The plan of work was (1) to reach the territory where paragonimiasis could be shown to be endemic, by finding strictly local cases of infection. (2) To obtain all the possible evidence from histories, and conditions of life of these cases pointing to a possible manner of infection. (3) To collect all animal forms in the territory such as snails, crustaceans, mollusks, fish, etc., which might serve as an intermediate host of paragonimus and to try to infect them with miracidia previously developed from paragonimus ova collected from individuals in Manila. The sputum was obtained and examined from every person that could be found in the vicinity who gave a history of expectorating blood. The sputum of a large number of individuals without such history was also examined. Three cases of infection with paragonimiasis were encountered in Gandara, and it appears that this parasite finds an endemic home in this locality. Attempts were made to infect with miracidia six species of snails, two kinds of arthropods, and a common small crustacean, all of which were collected in the vicinity in which the individuals acquired the disease and in which they lived. The results of these experiments have so far been negative. The study will be further pursued when opportunity offers.

The study of dysentery in Batangas.—In July Captain Whitmore was sent to Batangas to inquire into the nature of a severe epidemic of dysentery which had been reported to exist in that locality. Several hundred cases of the disease were reported to have occurred. The symptoms which Doctor Whitmore observed in the patients were those of acute bacillary dysentery, and from the stools of some of these cases he was able to isolate an organism morphologically and culturally identical with *Bacillus dysenteriæ* and which was agglutinated by a standard laboratory dysentery serum. No such widespread epidemic of bacillary dysentery has been known to occur in the Islands since 1900. The disease in virulent form is also much more prevalent in Manila and the vicinity than it has been for several years.

LEPROSY IN THE PROVINCES.

During the year six excursions were made through various portions of the Islands with a representative of the Bureau of Health, for the purpose of performing microscopical examinations in the diagnosis of cases of leprosy. In all 1,613 individuals were examined and in 1,135 a positive bacteriological diagnosis of leprosy was established. These cases were collected and sent to the leper colony at Culion.

Cultivation of the leprosy bacillus.—In connection with the work on leprosy may be mentioned the discovery of Mr. Clegg, of the laboratory, who has found that it is possible to cultivate the bacillus of leprosy on artificial media with amœbæ. The importance of this discovery requires no emphasis. Attempts to cultivate the leprosy bacillus have been undertaken for many years in various laboratories throughout the world but up to now have not been satisfactorily successful. The first paper of Mr. Clegg on this subject has already been published in February in the Philippine Journal of Science and a second one is now being prepared.

CHOLERA.

In July cholera again made its appearance in Manila and the number of cases increased up to September, reaching the highest point on September 20, when 60 cases were reported for that date. In September it was found necessary by the Honorable, the Secretary of the Interior, to call upon the Bureau of Science, which was already engaged in combating the epidemic, to assist the Bureau of Health in the care of the sick. The Chief of the Biological Laboratory acted as consultant at the San Lazaro Hospital and as attending physician at the Mary Johnston Hospital. Doctors Teague and Bowman were also assigned to duty at the Mary Johnston Hospital, and Doctors Andrews and Clegg at the San Lazaro Hospital. As in former years, the laboratory attended to the bacteriological diagnosis of the disease and the preparation of sera for diagnostic purposes. About 1,000 stools of cholera patients and cholera contact cases in Manila were examined by Mr. Clegg, in which the cholera organism was found in 350. It was found that the shortest length of time the spirillum remained present in the intestine and could be recovered from the fæces was five days and the longest eighteen days. The stools of 264 apparently healthy individuals in Bilibid Prison were examined for cholera vibrios, and this organism isolated from 17 (6.44 per cent). It seems probable that the introduction of cholera into Bilibid Prison may sometimes have occurred through these vibrios carriers. During the epidemic the stools of 376 apparently healthy people who had come in contact with cholera cases were examined and the cholera vibrio found in 27 (7.02 per cent). After the disappearance of cholera from Manila a large number of stools were examined over an extended period of time, but no typical cholera vibrios were isolated from any of these cases. It appears that the cholera organism does not exist for very long periods of time in the human intestine, and that after three of four weeks from its introduction the organism is no longer found to be present in the fæces of cholera carriers or in those of persons which have suffered from cholera. A distinct advance in the bacteriological diagnosis of cholera cases from the provinces was made this year. The method which has been successfully employed, consisted in mailing to the provinces where cases of cholera were suspected, agar cultures in tubes sealed with paraffin to prevent drying, and packed in tin boxes. With the tubes were forwarded sterile bits of wood. The local health officer was instructed by Doctor McLaughlin, Assistant Director of the Bureau of Health, to dip the sterile spatula of wood into the fæces from the suspicious case of cholera and to then smear it over the surface of the agar; then to reseal the tube and forward it to the laboratory in Manila. Experience has shown that in this way it was possible to prove definitely, bacteriologically, if cholera existed in certain of the provinces. The diagnosis could sometimes be made even though a week or more had elapsed between the time the tube was inoculated and the time it was opened at the laboratory. The serum division of the laboratory prepared all the saline solution which was employed for the intravenous and subcutaneous injections in the treatment of cholera cases in the Government hospitals in Manila. When the supply of disinfectants in the city became almost exhausted the disinfecting tank wagons were filled with sea water by the Bureau of Health and this was electrolyzed in the chemical laboratory; in this manner a disinfecting fluid was obtained capable of killing cholera spirilla promptly. The Manila water supply was examined bacteriologically daily during the epidemic but the cholera spirillum was never found therein. The esteros and sewers in Manila were also examined for the cholera organism on many occasions during the epidemic but always with negative results. During the previous year the cholera spirillum was isolated from one of the esteros.

Laboratory investigations.—The following investigations in relation to cholera have been undertaken in the laboratory during the year:

(1) A study of the manner in which the cholera organism produces the symptoms of Asiatic cholera and the manner in which it causes death.

(2) A study of the intracellular toxin of the cholera germ and a further search for a soluble toxin under various conditions of growth.

(3) Further experiments in the production of curative sera.

(4) A study of the morphological and biological changes which the cholera organism may undergo when it exists outside of the human body under various conditions, in esteros, etc.

(5) The effect of protozoa such as may be found in the water of Manila upon the virulence of the cholera organism outside of the human body.

(6) A study of the prevalence of the cholera spirillum in the stools of individuals coming in contact with cholera cases and who have no symptoms of the disease.

(7) A study of the virulence of the cholera organisms found in the stools of healthy individuals and of their power to produce infection in animals.

(8) The study of vibrios which resemble the cholera organism which were isolated from the stools in cases of intestinal disease or from water.

(9) Clinical studies relating to the disease.

(10) A study of the general treatment of the disease.

To enter fully upon the discussion of the results of these investigations in this report would occupy too much space. A number of papers upon these investigations have already been published in the Philippine Journal of Science during the year, and the remainder will appear in this Journal during the fiscal year 1910.

DIPHTHERIA.

For the first time since American occupation of the Islands, diphtheria was noted in Manila in something like epidemic form. During a period of a few weeks, about ten cases were diagnosed clinically and bacteriologically; since that time several sporadic cases have occurred. The cases were all treated with antidiphtheritic serum prepared by the serum division of the laboratory. All but two of these cases recovered and they were received for treatment after the disease was far advanced.

MEDICAL ZOÖLOGICAL WORK.

The studies relating to the prevalence of intestinal animal parasites in the Philippines, particularly in natives, have been continued throughout the year. In the neighborhood of 3,000 examinations were made in Bilibid Prison. Three hundred and eighty-five women and children in Manila and 1,000 inhabitants of Taytay were also examined for intestinal parasites. The results first obtained in Bilibid Prison, in which 84 per cent of the natives were found infected with animal parasites, 59 per cent with trichuris, 26 per cent with ascaris, 52 per cent with hookworms, and 23 per cent with amœbæ, have not been entirely substantiated by subsequent examinations of people living outside of the prison. For example, of 385 women and children examined in Manila, 87 per cent were found infected with trichuris, 53 per cent with ascaris and but 13 per cent with hookworms. Out of 1,000 examinations in Taytay 77 per cent were infected with trichuris, 82.9 per cent with ascaris, but 11.6 per cent with hookworms, and but 2.7 per cent with amœbæ.

A new intestinal trematode parasitic for man has been discovered by Doctor Garrison during the year and a full description of this parasite was published in the November number of the Journal of Science. In the cases in which it was found there were no apparent symptoms of disease. The development of paragonimiasis has also been carefully studied. While many questions regarding the development of the ova into the miracidia have been determined, the intermediate host for this parasite has not been found. The study of a human cestode parasite (tapeworm) apparently new, is now being pursued, and it appears to be a *Davainea.* It has surely not been described from these Islands before.

Helminthological collection.—The helminthological collection has been considerably added to and now numbers 500 specimens; an accession catalogue and a systematic card index have been started. It is hoped, now that the helminthological collection has been permanently established in the laboratory, that all helminthological material collected in the Islands will be sent for deposit in this museum. If the specimen can not be identified in Manila it can be sent from the laboratory to specialists elsewhere for identification and its safe return arranged for. The specimen will then be of value to all persons interested in the subject in the Islands.

DIAGNOSIS OF HUMAN BLOOD.

The laboratory has been called upon on numerous occasions during the past year to determine whether blood stains used as evidence in criminal cases were of human or animal origin. Owing to the cosmopolitan population of these Islands it would obviously be of great value in criminal suits if it were possible to differentiate between the blood of individuals of different races. A research of this nature was undertaken by Doctors Marshall and Teague, to determine whether such differentiation between Filipino, Caucasian, Negro, Negrito, and Chinese blood was possible. However, the conclusion arrived at was that none of the laboratory methods were sufficiently delicate for such a purpose. A similar research has since been carried out at Harvard University with the results in harmony with those obtained in this laboratory. So that, while there is no difficulty by laboratory methods in distinguishing between blood of human or animal origin, a more accurate differentiation can not be arrived at as yet by laboratory methods.

OTHER ROUTINE WORK.

Notwithstanding the absence of plague in Manila, the examination of rats for *Bacillus pestis* was carried on from time to time at the request of the Bureau of Health, however always with a negative result. Fourteen thousand four hundred and ninety-four microscopic examinations were made for the purpose of diagnosing cases of gonorrhœa.

Water analyses.—During the year 169 specimens of water were examined bacteriologically; these specimens were obtained from artesian wells, open wells, from provincial towns, and from esteros, sewers in Manila, and drinking waters bottled for sale. The waters obtained from artesian wells which had been drilled in various localities in the provinces showed in many cases very few bacteria and no evidence of fæcal contamination. Those collected from open wells, on the other hand, contained numerous bacteria and a large percentage of the cases showed evidence of fæcal contamination, and the presence of *Bacillus coli communis,* and were condemned for drinking purposes. Seven hundred and one specimens of blood, 962 specimens of sputum, and 7,334 specimens of fæces were examined during the year. In addition, 3,083 miscellaneous examinations were performed, which were not classified.

PUBLICATIONS AND INVESTIGATIONS.

Although so much of the time of the members of the staff has been occupied by routine work, particularly during the cholera epidemic, and by teaching in the Philippine Medical School, nevertheless, a considerable number of original investigations have been carried on. The following articles have been published from the medical section of the laboratory during the year:

The Prevalence and Distribution of the Animal Parasites of Man in the Philippine Islands, with a Consideration of their Possible Influence upon the Public Health, by Philip E. Garrison; A Report on the First One Hundred Autopsies at the Philippine Medical School, by Philip K. Gilman; The Diagnosis of African Tick Fever from the Examination of the Blood, by Richard P. Strong; Further Filtration Experiments with Virus of Cattle Plague, by E. H. Ruediger; A Mosquito Which Breeds in Salt and Fresh Water, by Charles S. Banks; A Study of the Precipitin and Complement Fixation Reactions, by Harry T. Marshall and Oscar Teague; A New Intestinal Trematode of Man, by Philip E. Garrison; A Reduction in the Cost of Anticattle-plague Serum, by E. H. Ruediger; The Inoculation of Bacterial Vaccines as a Practical Method for the Treatment of Bacterial Diseases, with Special Reference to the Treatment of Infections due to the Gonococcus, by Eugene R. Whitmore; Indications for Treatment in Asiatic Cholera, by Richard P. Strong; Streptothricosis with Special Reference to the Etiology and Classification of Mycetoma, with a Bibliography, by W. E. Musgrave, M. T. Clegg and Mary Polk; Trichocephaliasis, with a Report of Four Cases, Including One Fatal Case, with a Bibliography, by W. E. Musgrave, M. T. Clegg and Mary Polk; Filtration Experiments on the Virus of Cattle Plague with Chamberland Filters "F", by E. H. Ruediger; Address at the Commencement Exercises of the Philippine Medical School, by Paul C. Freer; Some Experiments on the Cultivation of Bacillus Leprae, by Moses T. Clegg; The Treatment of Asiatic Cholera During the Recent Epidemic, by Henry J. Nichols and V. L. Andrews; Remarks on Piroplasmosis, by E. Martini; The Development of Piroplasma and Trypanosoma of Cattle in Artificial Culture Media, by Eric Martini; Upon the Bactericidal Substances in Fibrin, by A. F. Coca; The Development of the Miracidium of Paragonimus Under Various Physical Conditions, by Philip E. Garrison and Ricardo Leynes; The Intestinal Worms of 386 Filipino Women and Children in Manila, by Philip E. Garrison and Rosendo Llamas; Some Investigations concerning the Food and Nutrition of the Filipino People, by Hans Aron; The Relation of the Indian Form of Relapsing Fever to African Tick Fever, by Richard P. Strong; Poisonous Snakes in the Philippine Islands, by Lawrence E. Griffin.

SERUM SECTION.

The work in connection with the care and immunization of the cattle used in the preparation of antirinderpest serum has been continued by the Bureau of Agriculture as during the previous year. The Bureau of Agriculture has continued to send to the Bureau of Science, in sterile bottles of five liters capacity each, all serum after it has been separated from the clot. The serum is centrifugated, filtered, bottled and tested for sterility at the Bureau of Science. At intervals of a few months, the potency of the serum is determined at the laboratory on nonimmune bullocks or carabaos. Nearly all the time of one assistant is occupied in centrifugating, filtering and bottling antirinderpest serum.

The installation of a large centrifugal machine of 10 liters capacity has greatly facilitated the work and a much larger quantity of serum can be prepared than was possible in previous years. The filtering apparatus also has been greatly increased in capacity during the year. As much as 50 liters of serum have been put up in one day. An attempt was made to centrifugate fresh, citrated antirinderpest blood to free the serum from corpuscles, but it proved to be unsatisfactory.

VACCINE VIRUS.

The preparation of vaccine virus has been continued steadily throughout the year and no difficulty has been encountered in supplying the demand.

BACTERIAL VACCINES, PROPHYLACTICS, SERUMS AND MISCELLANEOUS PRODUCTS OF THE LABORATORY.

Owing to the importance which the cutaneous and opthalmic reactions have assumed in the diagnosis of tuberculosis, special tubes of tuberculin have been prepared for this purpose and placed on sale. Cholera prophylactic, plague prophylactic, gonococcus vaccine, staphylococcus aureus vaccine, staphylococcus albus vaccine and staphylococcus citreus vaccine were prepared in moderate quantities. Antidiphtheritic serum, antitetanic serum, anticholera serum, antityphoid serum, antiplague serum, and antidysenteric serum were made in quantities sufficient to supply the demand. During the year one serum horse died from hemorrhage following rupture of the liver, which is the first death from spontaneous rupture of the liver observed in this laboratory.

Anthrax vaccine, tuberculin, both human and bovine, and mallein, were also prepared. Typhoid reagent, para-typhoid reagent and cholera reagent (killed cultures) for agglutination, were continually kept on hand. Agglutinating and bacteriolytic serums in liquid and in dried form for the purpose of the diagnosis of infectious diseases, normal horse serum, normal ox serum and normal carabao serum were always kept on hand.

INVESTIGATIONS.

The study of the etiology of rinderpest was continued by Dr. E. H. Ruediger, but so far its causative factor remains unknown. Tests were carried on with Chamberlain filters marked "F" in order to determine whether or not any could be found which would furnish an infectious filtrate of artificial peritoneal fluid. The filtrate was invariably non-infectious.

The question of the formation of anti-immune serum against antirinderpest serum was studied on cattle, and it was found that the more serum given to a bullock the less likely he is to die from rinderpest. There is no indication of the formation of anti-immune bodies or of the appearance of anaphylaxis in carabao repeatedly injected with cattle serum. Carabao have been shown to be less difficult to immunize against rinderpest than cattle.

ZOÖLOGICAL SECTION.

Fish and fisheries.—Mr. Alvin Seale left for the United States September 14, 1908, taking with him a large number of Philippine fish which could not be identified without access to the collections and literature in

America. In December, 1908, Dr. Lawrence E. Griffin was placed in charge of this division of the work until Mr. Seale's return. During December and January the assistant fish collector was employed in making collections of land shells in Mindanao. During April and May a study was made of the fauna of the Bantayan reef. A large number of species of fish and invertebrates, including several new species of fish, was collected here. A locality was discovered yielding very large sponges of good commercial quality. Directions for cleaning and preparing these sponges for market have been sent to the president of Bantayan, and it is probable that further exploration by the local fishermen will reveal further and more extensive sponge beds around the same reef, which will add materially to the resources of the town.

The sponge fisheries.—The sponge fisheries off Mactan Islands, Cebú, have now developed into a steady industry. Sponges of fine quality have recently been discovered on the east coast of Polillo Island. It seems probable that a thorough exploration of Philippine waters will prove sponges to be widely distributed and that a considerable source of revenue will gradually develop in sponges and other marine products not now utilized. The records do not show that any sponges have been shipped out of the Philippines during the past year. As fishing has been going on, either the sponges have been shipped out to Singapore, via Borneo, or the home market is absorbing the entire product of the fisheries.

A part of Mr. Seale's work in the United States has been to identify the commercial sponges of the Philippines and to submit samples to the large sponge dealers of the United States for quotations of prices. The results, with photographs of the different kinds of sponges, have been published in the Philippine Journal of Science. The prices quoted range from ₱20 a kilo for the best to ₱0.40 a kilo for the poor varieties. The demand for sponges is increasing much faster than the supply, and it is probable that even the poor grades of Philippine sponges will soon command higher prices. Sponges can be artificially propagated without much trouble, and there are many places in the Philippines, such as the Bantayan reef, where the conditions seem ideal for such work. Regulations were passed in June, 1908, governing the gathering of sponges in the waters of the Moro Province, where the principal known beds are located. Copies of these regulations may be obtained from the secretary of the Moro Province at Zamboanga.

Commercial fishes.—In another paper on the commercial fishes of the Philippines, published in the Philippine Journal of Science, Mr. Seale describes the most important of the Philippine food fishes, and the methods used in their capture. There is undoubtedly opportunity for the employment of more modern methods of commercial fishing in the Philippines. Fishes in the Manila markets cost from four to fifteen times as much as they do in some towns not far distant, and the cheapen-

U OF M

ing of the price of fish to the people of Manila, if it could be accomplished, would be conferring upon them a great blessing.

Marine invertebrates.—During the past year a systematic collection and study of the marine invertebrates of the Philippines has been commenced. The prosecution of this scientifically and commercially important work as well as of many problems connected with fishes, sponges, and pearl oysters, will necessarily be slow until some kind of a floating marine laboratory can be secured, so that work can be carried on advantageously and continuously. Recommendations covering the establishment of a floating laboratory were made in the annual report of the previous year.

Reptiles.—During the past year considerable additions have been made to the collection of reptiles in the museum. Among other facts which have been brought out, is the one that cobras are much more numerous in the Philippines than has been thought, and that they are responsible for a considerable number of deaths. Three species have been found. Unlike the natives of India, the Filipinos fortunately have no scruples about killing snakes.

ORNITHOLOGY.

The manuscript for a Manual of Philippine Birds has been completed and the first part has been published. The second and final part is now in press. Five papers of an ornithological nature have been prepared and published by Mr. McGregor in the Philippine Journal of Science, as follows:

Notes on a collection of Birds from Siquijor, Philippine Islands; Some Necessary Changes in the Names of Philippine Birds; Philippine Ornithological Literature, I; A Collection of Birds from Northern Mindanao; Philippine Ornithological Literaure, II.

Field work has been carried on in northern Negros, in Nueva Ecija and Benguet Provinces, and in the vicinity of Manila. During April and May Mr. McGregor was assigned to duty with the Bureau of Education and gave a course of instruction in ornithology at the Baguio Teacher's Assembly.

Advantageous exchanges have been completed with several institutions and individual collectors.

The Museum cases for specimens are now so crowded that a considerable number of additional cases will be needed before any further collections can be cared for properly. Although the bird room is small, there is no pressing need for more floor space at present. No attempt to exhibit mounted specimens has been made. This line of work may be undertaken as soon as extensive floor space and cases are available.

ENTOMOLOGICAL SECTION.

A large portion of the time of both Mr. Banks and Mr. Schultze has been taken up with the routine work of mounting and accessioning material brought to the laboratory owing to the failure to secure a properly trained Filipino for this work. Nevertheless, a large amount of work has been done in the identification, classification, and rearrangement of specimens and in selecting material for exchange and possible sale in the future.

ACCESSIONS.

The collection has grown steadily this year principally through donations and, to some extent, through collecting done by Mr. Schultze during his vacation and by both of the entomologists while in the field on specific investigations. The index cards show 11,239 accessions as against 9,248 for the previous year, representing approximately 6,000 pinned insects added to the collection. There are at least 10,000 specimens in paper and in alcohol to be transferred to boxes.

DONATIONS.

During the year the following exceptional donations have been made to the collection:

Mr. J. E. A. Wahr, Iloilo, P. I., insects from North Borneo and China, about 3,500 specimens.

Mr. W. L. Distant, Norwood, England, Cicadidæ from India, a large identified collection.

Mr. H. M. Curran, Bureau of Forestry, Manila, insects collected in forest investigations.

Mr. C. O. Waterhouse, British Museum, London, identified mosquitoes.

Dr. E. P. Felt, State Museum, Albany, N. Y., a large collection of mosquitoes of New York State.

Mr. R. C. McGregor, Bureau of Science, Manila, large collections of butterflies, mosquitoes and Hemiptera, made during trips for collecting birds.

In addition to these the laboratory has received smaller collections from Messrs. Merritt and Hutchinson, Bureau of Forestry; Messrs. Stevens and Mackie, Bureau of Agriculture; Messrs. C. Müller and R. Werm, Manila, and Mr. C. M. Weber, of Iwahig, Palawan, the latter having donated much valuable material.

IDENTIFICATION OF MATERIAL.

Mr. Banks left Manila in May, 1908, on leave, taking with him the entire laboratory collection of Culicidæ in addition to Hemiptera, Orthoptera, Coleoptera, Termitidæ and certain Lepidoptera for identification. Some time was spent in both the New York State Museum and the United States National Museum in studying the mosquitoes of America. Two months were spent in the British Museum where he succeeded in determining all the Culicidæ and most of the Hemiptera and Orthoptera which he had taken with him. Cerambycidæ and Buprestidæ were turned over to Doctor Waterhouse who kindly offered to identify them. Anthribidæ were taken to Dr. K. Jordan, at Tring, who has since sent back a large number of identified specimens; the remainder, consisting of new species, are to be sent later with manuscript for publication in the Philippine Journal of Science. Mr. W. L. Distant has identified considerable material in Rhynchota and will soon publish his results in the same journal.

At Paris, Mr. Banks worked in Doctor Bouvier's laboratory in the Jardin des Plantes identifying the Mallophaga or biting lice collected in the Philippines. In Dresden, he had the opportunity for a few days of working on Philippine Coleoptera with Doctor Heller. Through the assistance of Doctor Leonardi in Portici he was enabled to identify much of our material on Philippine Termitidæ. Other material of this nature will be determined and described by Doctor Silvestri. Since Mr. Banks's return he has been able to put the laboratory collection of Hemiptera and Orthoptera in a much more satisfactory condition as to identification and classification owing to the large amount of identified material brought back.

Mr. Schultze has rearranged and classified the greater part of the Lepidoptera (Rhopalocera) and most of the Coleoptera. This has occupied his time chiefly during the year. He has also prepared and mounted a large collection of Mallophaga collected on birds of the Philippines during several years past by Mr. McGregor. This material when worked up will form a valuable addition to our present knowledge. The collection is at present contained in about 435 boxes, but at least 250 more will be filled by it.

As a result of the work on mosquitoes at the British Museum, Mr. Banks has been able to recognize a number of new species and genera in the Philippine material.

ROUTINE DETERMINATIONS.

Both of the entomologists have been called upon to identify material in considerable quantity for other bureaus and for the public during the year. Some of these identifications have been published as editorials in the Journal of Science and the Philippine Agricultural Review. Under this topic it might be mentioned that frequent calls for information as to the locust, its habits and remedies, have come to the Bureau, especially during the latter part of the year. A note as to the best means of combating the pest was published in the Agricultural Review, but it evidently did not get the publicity it would have received had it been published in all the principal languages and widely distributed as was done with pamphlets on cholera and certain other circulars.

SILKWORM CULTURE.

The question of the introduction and establishing of silk culture in these Islands is of very great importance. It has been demonstrated by nearly three years of experimentation in breeding and hybridization that the Bengal-Ceylon silkworm will thrive most excellently here, producing 8 to 9 generations of fine cocoons every year.

The work of experimenting has gone on as opportunity has permitted and as time could be given for supervision.

The laboratory has been successful in introducing into Manila the "Eri" silkworm which produces the "tussar silk" of commerce. This worm feeds on the castor-oil plant (*Ricinus communis* L.) which grows as a weed throughout the Islands. The worm is easily cared for, being more hardy than *Bombyx mori* L., not so subject to disease and promises much for the future in this industry.

Thus far no disease or manifestation of disease has been noted in any of the silkworms and the twenty-first generation is now being produced without admixture of new seed. This is one of the greatest auguries for the success of silk culture in the Philippines.

Mr. Enrico Bartesaghi, a silk grower of more than eighteen years' experience in northern Italy, during a recent visit, was much astonished at the favorable outlook for silk production in Manila, and expressed surprise when told that our worms had never been subject to any disease. He stated that he believed the Philippines may become one of the greatest silk-producing countries in the Orient.

While in Washington, Mr. Banks secured from Doctor Howard two complete "4-pan Berthaud silk-reeling machines" of the most modern type and one of these has been set up in the laboratory. This machine is intended for use in demonstrating to the people the best methods for obtaining reeled silk in connection with the silk-culture laboratory which is at present in process of erection. As soon as this laboratory is completed we will have at hand a system which will show the entire process of silk culture up to a point where the silk is sent to the manufacturer. It is hoped that this will serve as an object lesson to those who may contemplate undertaking the work on a commercial basis.

Samples of silk have been sent this year to Switzerland, Italy and France for valuation, but with the improved machinery at hand we shall be able in the near future to submit more uniform grades.

RESEARCH.

In addition to the experiments on the hybridization of silkworms carried on during the entire year, principally by Mr. Schultze, some work has been done by Mr. Banks on the biology of Philippine mosquitoes, in continuation of work begun last year, and the results will be published later. Studies looking to the suppression, as a sanitary measure, of the breeding places of mosquitoes in Manila, also, have been carried on. This work has been done both with proprietary media and as an engineering proposition, viz, by draining, filling, etc. Work also has been started looking to a thorough study of the termites of the Philippines with a view to monographing this interesting and important group.

In March of this year Mr. Schultze was sent to Palawan to study an insect pest of cacao, reported to be of serious proportions at Iwahig; something over a month was spent at this work and the results will soon be ready for publication. Upon his return he brought a large amount of material, most of it new to the laboratory collection and some new to science. The "Rhynchota of Palawan" will form the title of a paper soon to be published by Mr. Banks on this material.

As the conservation of our forests is a question of prime importance, it is evident from the many requests received by the Bureau regarding insects injurious to trees that the services of a forest entomologist will shortly be needed by the Bureau to study this important phase of the work here.

BOTANICAL SECTION.

There have been no changes in the personnel of the botanical division during the past year, due chiefly to the policy adopted some time ago of increasing the salaries of the subordinate positions. This policy has had a most marked effect on the efficiency of the office force, as previously the tendency was for a man to resign at the end of two years, just at the time when his local training was becoming most effective, and seek employment in other Bureaus where higher salaries were offered. With the increase of salaries in the botanical section, this tendency has been overcome.

ECONOMIC WORK.

Much of the work of this nature is directly dependent on systematic botany, as it has been found to be worse than useless to attempt to do careful work of an economic nature on drugs, medicinal plants, oil and resin-producing plants, etc., without first knowing exactly what the species is that is being dealt with. The laboratory is now in a position accurately to classify most of the material brought in, and can accordingly prosecute economic investigations at greater advantage than previously. As in preceding years, a considerable amount of material has been secured in bulk and turned over the chemists of the Bureau for investigation, and in a great number of cases material sent to the chemists for report has been submitted to this office for identification.

One great difficulty encountered in securing material in bulk for chemical investigation, has been the matter of procuring the desired plant in sufficient quantity at any one time. To obviate this difficulty some plants producing essential oils have been grown on the grounds of the Singalong experiment station during the past year, but as this tract of land is about to be sold, it is proposed to utilize the vacant land just west of the Bureau of Science building, and this will be put into condition as soon as the rainy season has commenced. It is believed that this is the most satisfactory way of securing the necessary quantity of material of a number of species which it is desirable to investigate chemically.

Doctor Foxworthy spent some months in Borneo and the Malay Peninsula, his primary object being to secure data and information that would enable him to correlate the commercial timbers of the Philippines with those of the Malay region. In this he has been very successful and his paper on the subject will appear in the near future. During his trip Doctor Foxworthy also secured much information regarding the economic plants and their uses in the countries visited, and made extensive and valuable botanical collections in Borneo. He has also continued his investigations on the histology of Philippine timbers, and proposes soon to take up work on special groups, such as the *Dipterocarpaceæ,* our most important family of plants from the lumber standpoint, the mangroves and their vegetation, and other groups.

Doctor Robinson has investigated the commercial possibilities of *Parameria philippinensis* Radlk., as a possible rubber-producing plant, spending some time in southern Mindoro on this work. When the results in the extraction of the rubber are obtained, this work will demonstrate conclusively whether or not this plant has any commercial possibilities.

It has been the policy for all employees of the division, whether in the office or in the field, to compile information of an economic nature whenever possible; the card catalogue index to economic literature applying to the Philippines has also been greatly increased.

It is proposed to prepare at an early date a list of known Philippine medicinal plants, giving so far as possible their known and alleged properties, in order to have some definite basis for systematic investigation of this important subject.

The collection of woods, both Philippine and extra-Philippine, under the direction of Doctor Foxworthy has been rapidly increased, and is the most important adjunct to his investigations of Philippine commercial timbers.

PUBLICATIONS AND SYSTEMATIC WORK.

The amount of systematic work accomplished during the past year has been very extensive, and many valuable papers on the flora of the Philippines have been prepared and published, as follows:

Notes on Philippine Botany, by E. D. Merrill and R. A. Rolfe; New Philippine Plants from the Collections of Mary Strong Clemens, by E. D. Merrill; Notes on Philippine Gramineae, III, by E. Hackel; Lumbayao (*Tarrietia javanica* Blume), by F. W. Foxworthy; Alabastra Philippinensis, II, by C. B. Robinson; New or Noteworthy Philippine Plants, VI, by E. D. Merrill; Spicilegium Filicum Philippinensium Novarum aut Imperfecte Cognitarum, II, by C. H. Christ; Ferns of Southern China, by E. B. Copeland; A Revision of the Philippine Species of Athyrium, by E. B. Copeland; Fern Genera New to the Philippines, by E. B. Copeland; Perrottet and the Philippines, by C. B. Robinson; Philippine Freycinetia, by E. D. Merrill; The Oaks of the Philippines, by E. D. Merrill; The Genus Radermachera Hassk, in the Philippines, by E. D. Merrill; The Palms of the Batanes and Babuyanes Islands, by O. Beccari; New Genera and Species of Bornean Ferns, by E. B. Copeland; New Species of Cyathea, by E. B. Copeland; The Philippine Species of Garcinia, by E. D. Merrill; Philippine Ericaceæ, by E. D. Merrill; On a Collection of Plants from the Batanes and Babuyanes Islands, by E. D. Merrill; The Ferns of the Malay-Asiatic Region, Part I, by E. B. Copeland; On Halophila ovata Gaudichaud, a Neglected Species, by C. H. Ostenfeldt; Philippine Chloranthaceæ, by C. B. Robinson; Philippine Phyllanthinæ, by C. B. Robinson; Additional Philippine Symplocaceæ, I, by A. Brand; New or Interesting Philippine Ferns, IV, by E. B. Copeland; A Revision of Philippine Connaraceæ, by E. D. Merrill; A Revision of Philippine Loranthceæ, by E. D. Merrill; The Scitamineæ of the Philippine Islands, by H. N. Ridley.

These articles have all appeared in the botanical section of the Philippine Journal of Science. Other papers are in press at this time or in the course of preparation. The work of a systematic nature has been done by Mr. Merrill, with the assistance of several European specialists to whom material in various groups has been supplied, by Doctor Robinson, and by Doctor Copeland, of the Bureau of Education; the latter confining himself to the classification of Pteridophyta. In the formative stages of the herbarium about the only class of work that could be done was miscellaneous descriptive work, the diagnosis of new or supposedly new species, etc. The collections were naturally too incomplete to enable workers here to do complete monographic work of various groups of Philippine plants, and the same applied to questions of geographic distribution. Now that our collections are much more extensive and that so many different parts of the Archipelago are represented by collections of greater or less extent, monographic work can be more successfully accomplished, and with some hope of making the treatment of the various groups so considered, fairly complete. This policy of monographic work has been followed during the past year, and will be continued.

It is believed that in the near future work should be commenced on an enumeration, or at least a working list, of Philippine plants; classifying our material so far as possible family by family, working out the complicated questions of synonomy of all species considered, so far as it is possible to do so. Such an enumeration would be of very great value, and should be followed up by a comprehensive "Flora of the Philippines," in which an attempt should be made to classify and describe all known Philippine plants. A "flora" would be a very extensive undertaking and one that would take a number of years to complete, but as it is one of the ultimate objects of our present systematic investigations it should not be lost sight of. At present, our herbarium represents the only place in the Archipelago where Philippine plants can be classified and is available only to persons located in Manila; but the publication of a comprehensive "flora" would enable anyone interested in the subject to make his own identifications.

HERBARIUM.

This most important and absolutely essential adjunct to all work of a systematic and economic nature on the botany of the Philippines has shown a gratifying growth. The total number of specimens received, mounted, poisoned and distributed in the herbarium was 12,699, somewhat less than for the preceding year.

The accessions are as follows:

Collections made by employees of the Bureau of Science	3,171
Collections made by employees of the Forestry Bureau	5,741
Collections made by employees of the Bureau of Agriculture	57
Miscellaneous Philippine collections, received as gifts or by exchange	1,158
Foreign material received in exchange	2,572
Total	12,699

The notable collections received, other than those made by employees of the three Bureaus mentioned above, are 156 specimens of Cuming's Philippine Ferns, received from the British Museum, making our set of this historical collection nearly complete so far as the ferns are concerned; 550 specimens of Philippine ferns collected by and presented by D. LeRoy Topping, of the Bureau of Audits; and 100 specimens of Copeland's Pteridophyta Philippinensia Exsiccata, besides numerous other Philippine ferns presented by Doctor Copeland.

The most valuable accessions of extra-Philippine material has been a collection of about 590 numbers made by Doctor Foxworthy, of this division, in Borneo; 780 specimens of Henry's China and Formosa collections received from the United States National Museum; 176 specimens from the Malay Peninsula, received from the Botanic Garden, Singapore, and 204 specimens of Indian and Malay Peninsula plants received from the Royal Botanic Garden, Calcutta.

The total number of specimens now in the herbarium is about 73,744; of which 49, 290 are Philippine and 24,454 are foreign, the latter largely from India, Malaya and China.

EXCHANGES.

A considerable number of duplicates have been distributed during the past year to various institutions with which we have exchange relations. One institution, the Jardin Botanique de l'État of Brussels, Belgium, has been added to the exchange list the present year. Below is given a summary of specimens distributed:

United States National Museum, Washington, D. C.	2,494
New York Botanical Garden, Bronx Park, N. Y.	368
Royal Gardens, Kew, England	632
Kgl. Bot. Gartens, Berlin	236
Royal Botanic Gardens, Peradeniya, Ceylon	135
Botanic Gardens, Sydney, N. S. W., Australia	927
Dr. H. Christ, Basle, Switzerland	70
J. Kneucker, Karlsruhe, Germany	70
J. Kaulfass, Nunberg, Germany	83
Dr. E. Levier, Florence, Italy	120
N. C. Kindberg, Upsala, Sweden	90
Musea Kral. Ceskeho, Prague, Austria	200
Gray Herbarium, Cambridge, Mass. U. S. A.	613
Missouri Botanical Gardens, St. Louis, Mo.	678
Botanical Institute, Imperial University, Tokyo, Japan	282
Jardin Botanique de l'État, Brussels, Belgium	632
Total	7,630

In addition to the above material distributed as exchanges, the following 808 specimens were sent to various specialists for identification and can properly be classed as duplicates distributed:

Lichens to Dr. E. A. Wainio, Helsingfors, Finland	468
Symplocos to Dr. A. Brand, Frankfurt a. d. Oder, Germany	20
Ilex to Dr. Th. Loesener, Berlin, Germany	19
Mosses to Dr. F. Brotherus, Helsingfors, Finland	204
Hepatics to Herr. F. Stephani, Leipzig, Germany	72
Carex to Rev. G. Kukenthal, Koburg, Germany	25
Total	808

The total number of specimens distributed was 8,438.

Loans of mounted material to specialists who are working on monographs of various families aggregate 1,276 mounted specimens and have been made as follows, frequently duplicate specimens also have been supplied the monographer:

Impatiens to Sir Joseph Hooker England	25
Palms to Dr. O. Beccari, Florence, Italy, about	20
Piperaceae to C. de Candolle, Geneva, Switzerland, about	200
Rubus to W. Focke, Bremen; Germany	32
Orchidaceæ to Oakes Ames, North Easton, Mass., U. S. A.	332
Vittaria to R. C. Benedict, New York	257
Gesneraceæ to Fr. Kränzlin, Berlin, Germany	235
Nepenthes to Prof. J. M. MacFarlane, University of Pennsylvania	30
Palaquium to Prof. M. Dubard, Paris, France	51
Freycinetia to Dr. U. Martelli, Florence, Italy	94
Total	1,276

In addition to the above material, 14 species of Gramineæ and Cyperaceæ, about 120 specimens of each, have been sent to Herr. J. Kneucker for distribution in his "Glumaceae Exsiccatae;" and one species of bamboo, about 40 specimens, have been sent to C. F. Baker, Claremont, California, for distribution in his sets of "Economic Plants of the World." In both cases fascicles of the sets will be received in exchange.

We are under obligations to Mr. S. T. Dunn, the director of the botanical and afforestation department, Hongkong, for a loan of all the ferns contained in the Hongkong Herbarium, which were sent at the request of Dr. E. B. Copeland, and studied by him in the preparation of his paper on the "Ferns of the Indo-Malayan Region."

BOTANIC GARDEN.

The necessity for the establishment of a botanic garden and the advantages which would result in the economic development of the country were pointed out in the annual report for the previous year.

The question of the ultimate establishment of a botanic garden, either in connection with this or some other Bureau, or independently, should not be forgotten. This has been recommended annually for several years but so far without materials results. It is suggested that a committee be appointed by the Honorable Secretary of the Interior to consider and report upon the matter.

THE CHEMICAL DIVISION.

INVESTIGATIONS AND PUBLICATIONS.

The following investigations begun previous to July 1, 1908, were completed and published during the year in the Philippine Journal of Science:

Philippine Terpenes and Essential Oils, III, by R. F. Bacon; A Rapid Clinical Method for Determining the Ammonia Coefficient of Urine, by R. F. Bacon; The Economic Possibilities of the Mangrove Swamps of the Philippines, by R. F. Bacon and V. Gana.

Editorials on topics of scientific and general interest appeared as follows: The Tensile Strength of Machine and Hand Stripped Abacá Fibers, by R. F. Bacon; The Excreta of the Python, by R. F. Bacon; A Rubber Vine, by R. F. Bacon; Notes on the Action of Sodium Alcoholate on Alcohols, by R. F. Bacon; Philippine Turpentine, by G. F. Richmond.

PROBLEMS UNDER INVESTIGATION.

The work on Philippine coniferous and dipterocarpus resins outlined in the last annual report is practically completed and will be published as soon as the coöperative field work with the Bureau of Forestry outlined below, is accomplished.

Further study of the medicinal plants of the Philippines has been made. Thus far the three alkaloids, strychnine, berberine and hyoscyamine have been isolated and studied. The work on essential oils has been continued as fast as material from our experimental plots and other sources was available. Further data on vetiver and cinnamon oils is at hand and ocimum oil not hitherto reported upon has been investigated.

CEMENT INVESTIGATIONS.

The work already published has been continued throughout the year. A special study of the physical and chemical properties of the various brands of Portland cement obtained from America, Europe, China and Japan has been made. These cements are being tested under all conditions of seasoning and aëration as affecting their setting, tensile, and compression strength properties. An extended inquiry of the causes of quick setting of cements, and the corresponding effect of gypsum and lime is included.

PAPER PULP AND PAPER INVESTIGATIONS.

Incidental to the thorough working out of the pulp value of a species of bamboo submitted from China, many new and important features connected with the commercial utilization of this promising new source of supply have been determined. They will be included, together with further work on Philippine woods, in a fourth paper of the series on this subject which will be published shortly.

SUGAR INVESTIGATION.

Realizing the importance of the sugar question in the Philippines, Mr. Walker was sent to Negros in December for the purpose of making a preliminary survey of the sugar-cane district. He returned to Manila in June, having obtained data upon the cultural and milling methods for sugar cane in that region, and is now engaged in assaying the sugar soils collected during the trip, and in making a report of his studies.

Comparatively little is known concerning the present methods of sugar production in the Philippines, and it is expected that the results obtained will afford valuable data for comparison with the known methods in vogue in Java, Hawaii, and elsewhere. Considerable information in regard to the handling and grading of this commodity at the port of Iloilo was also secured which will prove of great assistance in the establishment of the sugar-testing laboratory at that place, already provided for by the law effective July 1, 1909. The necessary apparatus and equipment for the sugar-testing laboratory was ordered in July and it is expected that the laboratory will begin operation about November 15th, 1909.

RECOMMENDATIONS FOR FUTURE WORK.

An outline for future coöperative work with the Philippine Bureau of Forestry includes the following minor forest products:

For the completion of work already under way:

(1) It is essential that more definite data be obtained as to how fresh Manila

copal is produced. Commercial collectors of this resin state that at least 90 per cent of the present exportation is obtained directly from the living trees. This is contrary to the usual belief and, if true, Manila copal practically ceases to be a product of the mine and becomes a forest product of considerable importance. Data is desired concerning the yield which may be obtained from tapping or boxing the living trees, the effect of seasonal changes upon the rate of flow and the cause of deposits of masses of the hardened resin on or near the roots of living trees.

(2) The laboratory will require more of such varieties of dipterocarpus resins as show promise of being produced in commercial quantities for the purpose of further study and authentic identification of similar material on hand.

(3) In view of the general inquiry all over the world for new sources of supply for paper stock, further search for available pulp woods and bamboos seem important.

FOR PROSPECTIVE INVESTIGATIONS.

(1) Many native woods contain valuable dyes which find local use but upon which no chemical work has been done. It is planned to investigate such material.

(2) A study of such gums as may be collected in quantity is contemplated. These gums in distinction from the resins are almost invariably the coagulated latex or milky exudation obtained by cutting or otherwise wounding the bark of certain trees or vines. A number of specimens of these gums from different sources have been received, but in almost every instance the small amount of material submitted and the absence of botanical material has prevented a correct classification of the substance. The new and increased uses for rubber and gutta percha and the consequent increase in the value of these gums has brought about an extended search for new sources of supply. As a result of such inquiry elsewhere, many new gums have been found and their chemical and physical properties investigated. Almost without exception a new gum has been found upon examination to partake more or less of the properties of either rubber or gutta percha and it is hoped that a careful survey of the Philippine forests for this class of material will bring to light something of value.

ROUTINE WORK OF THE CHEMICAL LABORATORY.

There has been an increase in the volume of the routine analytical work done as compared with the previous year. The laboratory records show the following number of analyses and examinations performed for the two periods in question:

Item.	1907-8	1908-9
Cements	1,314	2,788
Urines	416	413
Waters	72	99
Papers, fibers and textiles	62	84
Paints pigments, varnishes, dyes	39	43
Oils, fats, waxes and soaps	26	48
Gastric and toxicological examinations	18	23
Miscellaneous examinations	40	706

CEMENT.

The great increase in the volume of the cement work noted in the last annual report was maintained throughout the present year. Under this heading is included in the table above, over 30 samples of native rocks, sands and gravels which were examined for their suitability for concrete construction. The results obtained prove very conclusively the advisability of a thorough examination of these materials for all important construction work.

WATERS.

Of the 92 waters examined, 54 were from artesian wells, 14 were from mineral springs, 15 were distilled waters from various sources, and the remaining 9 were surface waters for boiler purposes. In the case of the artesian waters examined, where there was absence of information concerning the water-bearing strata of the wells, the chemical findings were frequently considered unsatisfactory from a sanitary standpoint. In some cases, the results obtained were due to unsanitary methods of collection, but more often to the age of the samples examined. It is impossible to obtain perfectly fresh samples for our tests except from those wells which are located in or near Manila; hence it is not believed that the use of these waters for drinking and domestic purposes should be curtailed necessarily on account of the results found under such conditions.

A considerable amount of the work recorded under fibers, oils and miscellaneous examinations was of a commercial nature; e. g., upon Philippine fibers, petroleum and turpentine, and was much more extensive and time consuming than mere mention in the tabulation of analyses made would indicate. Such work largely consisted of a comparative study of the suitability of the material in question for the well-established purposes of similar products elsewhere.

THE SECTION OF WEIGHTS, MEASURES AND MINERAL ANALYSIS OF THE CHEMICAL LABORATORY.

The laboratory of inorganic and physical chemistry has completed in the last year a rather large amount of routine work for which payment has been received, as well as kept up its active interest in chemical research.

ROUTINE WORK.

The task of unifying and enforcing the use of correct weights and measures in the Philippine Islands as provided by Act No. 1519, known as the Weights and Measures Act, has been a prolonged one. From the beginning the laboratory has been handicapped by the difficulty of obtaining satisfactory standards in sufficient numbers to make the law completely operative. By the end of the last fiscal year, all of the provinces had been provided with secondary standards but it was soon discovered that one set was not sufficient to standardize all of the weights and measures in a province without great inconvenience and delay. Since one of the principal uses of the standard weights is the testing of steelyards, some inconvenience was caused by the lack of suitable supports for the former. A scale pan was devised for this purpose which consists of an aluminium disk supported by brass chains attached to a suitable hook so that it can also be used as a poise. The whole weighed exactly 500 grams.

It was mentioned in the report of the previous year that some of the municipalities had expressed a desire to own their own standards also. In order to satisfy that demand, it was at first proposed to have the Purchasing Agent order 160 sets of third-class weights, scale pans, measures of capacity, measures of length, and small rods equal to the cubical dimensions of the measures which would be sealed for measuring dry substances. Since that time the desire on the part of the municipalities for these measures has become almost universal, and there have been received by this laboratory, through the Bureau of Internal Revenue, requests from 416 municipalities for these sets. The Purchasing Agent has ordered in all 450 sets of such standards to fill these orders and leave a very few on hand. A large number of these have already arrived.

In order to insure initial accuracy and to hasten the time when these sets can be distributed and ready for use, this laboratory has undertaken the standardization of them, although it was the first intention to have the municipal standards compared in each provincial capital with the provincial set. Hereafter in case of question, that will be done, and only the provincial standards returned from time to time to the Bureau of Science for restandardization. Up to the present time as many as 350 sets of municipal metric standards have been received. During the last fiscal year all that are on hand have been tested, or corrected and retested as the case may be, and prepared for distribution as follows:

Weights, (including scale pans)	1,282
Measures of length	350
Measures of capacity	2,100
Rods for measuring cubical dry measures	1,648

This Bureau has been obliged to manufacture some of these measures in order to get them into use without too great delay.

Some of the Government scales which have been in use for a long time were graduated only in the English system. Ten platform scales, a greater number of spring balances, and a number of weights have been changed to the metric system without great inconvenience.

Miscellaneous measures and measuring devices, optical and electrical instruments, thermometers, etc., have been worked over and standardized.

In addition to its work of standardization, this laboratory has also performed a fairly large amount of other paid routine work.

There are now private assay plants in nearly every mining district that is doing development work and this is as it should be, for it is impossible to send samples any distance and await the returns when one is doing any active work. However, that the laboratory is still as useful to the prospector as heretofore is evidenced by the fact that the number of assays would be slightly greater than that of last year, if one item of a large number of samples from a single source and taken for a specific purpose be omitted from last year's record.

About twenty rocks and minerals, exclusive of coal, were analyzed, in which over one hundred and thirty constituents were quantitatively determined. These do not include a number of samples analysed for purposes of our own research. A number of coal samples have been analyzed and their calorific value determined for private individuals. Also a very large number of coal analyses have been made for purposes of research. In addition, a great amount of miscellaneous work which it is difficult to classify has been done for other bureaus of the Government or for purposes of research.

INVESTIGATIONS AND PUBLICATIONS.

The work on cement, clays and coal begun during the previous years, and on which several articles have been published, has been continued.

An article on "Philippine Raw Cement Materials" is now in the hands of the printer and a small paper on the same subject containing some of the same material will also appear as an exhibit in "Mineral Resources of the Philippine Islands," a yearly publication issued free by the mining division of this Bureau.

An article on "Volcanic Tuff as a Construction and a Cement Material" was published in the Philippine Journal of Science during the year. Owing to the scarcity or nonavailability of good building rock in the Philippine Islands, volcanic tuff has been largely used in construction. Before it is disturbed this tuff is so soft that it can be quaried with an ax, but it hardens rapidly on exposure. The ultimate crushing strength per square centimeter averages about 150 kilos. It is computed that, using a safety factor of 10, a good quality of tuff would be suitable for the erection of structures 11 meters high. The chemical composition of Philippine tuff is not greatly different from that of Panama rhyolite tuff, which latter is known to make a cement of good quality.

At the request of the Bureau of Education the clays of Laguna Province were investigated. The work done upon the material was fairly complete. It shows that while true kaolins exist the indications are that all of the high-grade clays are more or less mixed with clay of poorer quality. It is a question what percentage of the mixture is useful and whether the expense of sorting will not be so great that it can not compete with kaolin from other sources.

An investigation has been made of the juice of the *Litsea chinensis* known to the Tagalogs as *puso-puso* and long used by native masons in making mortar. They believe that the addition of this substance makes the mortar harder. Tests show that the initial hardening is more rapid when the juice is used, but that in the final set the tensile strength is the same or somewhat less than when water is used alone.

The work on the practical utilization of Philippine coals, recently published, is the first paper published on Philippine coals where complete data on so many samples is given. The article has been of especial interest to the Navy, railroads, shipping firms, engineers and consumers of coal in general. Philippine coals are nearly all noncoking. It is believed that they can be successfully used under boilers when burned in a long fire box with a sufficient number of baffle walls; they can probably be most advantageously used in gas producers where they have the advantage of not clinkering. The investigation of coals is being continued. A paper on "Calorimetry, and the Determination of the Calorific Value of Philippine and other Coals from the Results of Proximate Analysis" is in press, and the study of some phases of the deterioration of coal in storage has been begun.

Some work on fuels other than coal has been done. An article on "Industrial Alcohol and its Possibilities as a Source of Power in the Philippines" is in press, and it is expected that a preliminary study of Philippine firewoods will shortly be made.

GAS PLANT.

A committee, consisting of Messrs. Cox, Richmond and Reibling, were appointed by the Director of the Bureau to discuss the best means of installing a proper gas plant for the group of buildings consisting of the Bureau of Science, the new Philippine Medical School buildings and the Philippine General Hospital.

The present gas plant of the Bureau of Science is inadequate to supply all of these buildings, and although an expensive one it was the cheapest means of obtaining gas in small quantities such as have heretofore been used. For various reasons it seemed inadvisable to the committee to recommend installation of a coal-gas, a water-gas, or a gasoline-gas plant. Under the circumstances the best solution of the problem seemed to be to operate in conjunction with our present gas plant enlarged by two units (two retorts) a gas-producer plant. The gas at present in use by the laboratory is made from Cape axle oil and kerosene. It is high in illuminants and is diluted with about 30 per cent of air before it can be used in the laboratory burners. The use of Philippine coal in a gas-producer plant has often been suggested. It is very desirable that a plant be installed at the Bureau of Science for experimental purposes. The gas from such a plant enriched by that from our present plant would make a very suitable laboratory gas and the cost of production would be greatly reduced and probably as cheap, or cheaper, than that produced by a coal-gas plant unless it were possible to utilize the by-products. In addition, the producer-gas plant would be valuable for experimental purposes. A plant of probably not over 20 horsepower capacity would be suitable for experimental purposes, and the gas diluted with 30 to 40 per cent of that from the present plant would burn well in the laboratory burners. As the development of the coal industry in the Philippines is a very important one from many standpoints, it will be interesting to observe what can be accomplished by the use of Philippine coal in gas-producer plants.

LABORATORY FOR FOOD AND DRUGS INSPECTION.

The examinations performed during the past year (the second year of the enforcement of the "Food and Drug Law," Act No. 1655 of the Philippine Commission May 18, 1907) have disclosed a greater percentage of violations of the law than was discovered in the previous one.

During the year ending June 30, 1908, 722 samples were examined, of which 310 or 43 per cent were illegal. During the year ending June 30, 1909, 599 samples were examined of which 319 or 51.17 per cent were found to be illegal.

This state of affairs is due in a measure to the experience which has been acquired by the inspectors in selecting the samples to be sent to this laboratory, and also to the fact that inspection has been extended to various classes of food and drugs where adulterations and misbrandings are more apt to be found. The smaller number of samples handled during the year has been due to the more difficult character of the work. The entire available time of one man (Mr. Holmes) has been occupied for a number of months exclusively with the analysis of whiskies, brandies and other distilled liquors.

The inspection of drugs has also been extended to assist in the enforcement of the "Opium Law," Narcotic Drug Act 1761 of the Philippine Commission.

The examination of food products native to the Philippine Islands was seriously taken up during the year and a number of interesting investigations have been completed. Articles descriptive of these products are almost ready for the press. It is hoped that these investigations can be continued during the coming year. The examination of lards from

Philippine hogs and the feeding experiments with copra cake have been carried as far as practicable at present and the interesting results obtained are now ready for publication in the Philippine Journal of Science.

The various examinations made during the year for the purpose of enforcing the Food and Drug Act and the Narcotic Drug Act are tabulated on the attached sheet to show the source and character of the article and the violation of the law if any was found.

INVESTIGATIONS AND PUBLICATIONS.

The following articles were published by Mr. Gibbs in the Philippine Journal of Science during the year:

Food and Drug Inspection; Methyl Salicylate, The Separation of Salicylic Acid from Methyl Salicylate and the Hydrolysis of the Ester; Methyl Salicylate, Solubility in Water at 30°; On the Detection and Determination of Coconut Oil, (with F. Agcaoili); Proprietary Medicines in the Orient; The Compounds which Cause the Red Color in Phenol.

The research work at present in progress consists in a continuation and a conclusion of the work upon methyl salicylate, and investigation of some reactions of sunlight and the oxidation of aniline.

Mr. Gibbs, with the assistance of Mr. Agcaoili, is pursuing investigations upon lard and carrying on analyses of some native foods. Mr. Holmes is carrying on an investigation of some properties of the iodides of the alkaloids morphine, codeine and heroine, and also has ready for publication an article on a criticism of the methods for the determination of fusel oil.

Mr. Gibbs has discovered that many samples of preserved fruits entering the port of Manila contain formaldehyde and has traced the occurrence of this preservative to the decomposition of sugars. A thorough investigation of this question is planned and over 1,000 samples of preserved fruits have been collected for experimentation.

The number of assistants in this laboratory is insufficient to carry on the work that should be performed by it. Many more examinations of food stuffs should be completed during the year.

Summary of the samples examined.

Kind.	Number of samples.	Illegal.
ANIMAL PRODUCTS.		
Bacon	1	
Corned beef	2	
Ham	8	1
Oysters	3	3
Salmon	16	9
Sardines	17	11
Fish in tins (miscellaneous)	14	13
Sausages	5	2
Meats (miscellaneous)	24	20
Lard	1	
Milk	13	1
Human milk	9	
Sterilized milk	6	3
Condensed milk	16	9
Sweetened condensed skimmed milk	2	1
Butter	15	6
Margarine, imitation butter	2	1
Cheese	22	8
VEGETABLE PRODUCTS.		
Flour	1	1
Vermicelli	3	3
Canned fruits	12	4
Preserved	4	2
Jelly	4	3
Vegetables	17	2
Canned vegetables	46	23
VEGETABLE PRODUCTS—ct'd.		
Vegetable products (miscellaneous)	8	2
Sugar and related substances	14	1
Condiments	6	1
Flavoring extracts	13	2
Edible oils	2	
Roasted coffee	6	2
Beverages:		
Nonalcoholic	26	15
Alcoholic—		
Wine	20	3
Beers	2	
Ale	4	2
Rye whisky	38	33
Borboun whisky	3	3
Scotch whisky	51	46
Rum	2	2
Brandy	9	9
Cognac	14	14
Gin	16	1
Bassy	6	
Vermouth	1	
Cocktails	1	
Vinegar	1	1
United States Pharmacopœia preparations	52	31
Proprietary medicines	41	27
Total	599	321

DIVISION OF MINES.

Doctor Smith, the chief of the division of mines, was away on leave for ten months, two of which were spent in Europe studying paleontological material.

The following changes in the staff have occurred during the year:

Mr. Frank T. Eddingfield, mining engineer, was appointed in July to fill the vacancy caused by Mr. Goodman's resignation. Dr. George I. Adams, geologist, was also appointed on the staff August 1, 1908. Mr. Robert Clark resigned March 15. Both Mr. Goodman's and Mr. Clark's resignations were accepted with regret by the Bureau. The two remaining vacancies which exist in the staff will shortly be filled.

Field work accomplished.—The field work done by members of the staff of the division during the past year may be summarized as follows:

An inspection of the mining districts of Lepanto and Benguet by Mr. Goodman; the exploration of Mount Kawa in northeastern Luzon;

Unable to scan

This page

the investigation of the coal deposits in the vicinity of Alcala; and the examination of the mining districts of Masbate, Paracale, and Batan, by Mr. Ferguson; Doctor Adams has completed a reconnaissance of a portion of southwestern Luzon. The manuscript for most of this report has already been prepared and a map to accompany it completed. A reconnaissance of the Island of Leyte was made at the request of the Director of Public Works, in order to study the conditions governing the drilling of deep and artesian wells. As a result particularly of these investigations, Doctor Adams has collected and put into convenient shape for reference and exhibit, the drilling records and samples from wells being drilled throughout the Islands. The results of this work have been considered so successful that the Director of Public Works has asked that Doctor Adams be detailed to that Bureau for further investigations relating to the drilling of all wells in the Islands. Doctor Adams has also recently examined the oil fields of Tayabas and has reported that the oil showing and the shallow test well, indicate that the field is well worth prospecting.

Examination of structural materials.—The recent economic development of the Philippines has required the expenditure of large sums of money for the construction of roads and bridges, railways, harbor and river improvements, and public buildings, all of which have created a demand for structural material. The division, and particularly Doctor Adams, has performed considerable work for the Bureau of Public Works and the city engineer's office in regard to the study of structural materials, such as sand, gravel, crushed stone, road materials, building stone and clay products. The granular-metric composition of the sands available for use in Manila has been investigated; it has been found that the sand of the Orani River shows, according to tests made in the cement laboratory of this Bureau, about 50 per cent greater efficiency than the Pasig sand. The city engineer has secured some of this sand and it is being employed in making concrete paving blocks which are being tested in the streets of Manila; it has also been specified for constructing the shaft in the rebuilding of the Magallanes monument. Doctor Adams also investigated for the city of Manila possible quarry sites for supplying crushed stone for macadamizing streets; he tested the materials which were available, and found a new site of superior stone near Angono. The city engineer is now taking steps to secure the quarry site and to remove the stone-crushing plant from the present location on Talim Island. The efficiency of stone from the Sisima quarry has also been tested, the quarry site examined, and the stone tested for the United States Army Engineers at Corregidor. A machine for making standard abrasion tests on stone to be used for macadamizing roads has been constructed in the laboratory, and a series of preliminary tests has been made on materials found and used near Manila. At present work is being done for the Bureau of Public Works in testing stone used for construction in the provinces. In this connection it seems desirable that there should be purchased by the laboratory in the near future apparatus for testing completely these materials of construction. For this purpose one impact machine, one rattler, one machine for testing hardness, one for procuring drill cores, and one for obtaining the crushing strength of rocks, will be necessary.

PUBLICATION AND INVESTIGATIONS.

The Second Annual Bulletin of the Mineral Resources of the Philippine Islands, for the year 1908, has been recently issued by Doctor Smith, and this publication in addition to the introduction and the mineral statistics by Doctor Smith, contains the following articles:

The Nonmetallic Minerals, by Warren D. Smith; The Metallic Minerals, by H. G. Ferguson; Statistics, by H. G. Ferguson; Philippine Raw Cement Materials, by A. J. Cox; The Gold Fields of Surigao Peninsula, Mindanao, by Maurice Goodman; The Production of Structural Material, by George I. Adams.

Dr. Smith during his vacation prepared an article on Geographic Exploration in the Philippine Islands for the Journal of the Royal Geographic Society, and one on the Coal Resources in the Philippines, published in "Economic Geology.' The following articles are in preparation at the present time:

A Monograph on Tertiary Fossils of the Philippines, by Dr. Smith; A Geological Reconnaissance of Mindanao and Sulu, of which the narrative part has already appeared, by Dr. Smith; Areal Geology of South Central Luzon, with Particular Reference to the Vicinity of Manila, by Dr. Adams; Report on a Reconnaissance of Leyte and Samar, by Dr. Adams; Complete Bibliography of Philippine Geology and Mining Literature, by Mr. Ferguson; A report on the Geology of the Masbate Mining District, by Mr. Ferguson; The volcanoes in Northern Luzon, by Mr. Ferguson.

ORE-TESTING PLANT.

In the report for the previous year recommendations were made concerning the establishment of an ore-testing plant for the laboratory, where a working test could be made upon three to five ton samples of ores. In relation to this matter, Doctor Smith during the year visited the Allis-Chalmers Manufacturing Company in Milwaukee and obtained plans and specifications for a small testing plant. The total cost of the establishment of a sufficiently complete plant to be able to test all classes of ore will be in the neighborhood of ₱50,000. The original cost of the plant to the Bureau would eventually be paid for by the fees charged for the ore tests.

BRANCH MINT.

The establishment of a branch mint in the Philippines for the purpose of assaying and buying Philippine bullion was also considered in the previous annual report. This matter should not be lost sight of; the advantages of such a branch mint need not be repeated here.

No steps have as yet been taken in regard to legislation respecting mine inspection; it is recommended that this matter be brought to the attention of the Legislature at its next session. A provisional mining section code has already been prepared in case it is desired by the Legislature.

SCHOOL OF FINE POTTERY.

It is understood that the Bureau of Education has for some time considered the establishment of a school for making fine pottery. It appears that it would perhaps be more desirable to establish a school for teaching Filipinos the manufacture of the coarser grades of pottery, brick and cement, since these are materials that are in constant demand in the Islands, and, whenever made and in whatever quantity, will always be assured of a market. It might be desirable for this Bureau to have the coöperation of the Bureau of Education in this matter, and to purchase one or more kilns for burning and testing clays. At the present time we have no furnace which will give a sufficiently high temperature to test satisfactorily the few clays that have been sent to the laboratory.

IMPROVEMENT IN THE MINING INDUSTRY.

It is a satisfaction to be able to state that the mining industry has made tremendous leaps in the last year. In 1907 the gold production was estimated to have amounted to about *₱140,000,* and in 1908 to have increased to about *₱340,000.* The total wealth resulting from mineral products in the Philippine Islands amounted to nearly ₱2,000,000, the nonmetallic products being greatly in excess of the metallic. The full details of the mineral resources of the Islands will be found in the Second Annual Bulletin of the Mineral Resources issued from this Bureau.

THE DIVISION OF ETHNOLOGY.

PUBLICATIONS AND INVESTIGATIONS.

During the past year the following works have been published:

The History of Sulu, by Dr. N. M. Saleeby; A Vocabulary of the Igorot Language as Spoken by the Bontok Igorots, by Rev. Walter C. Clapp. A paper by Mr. Christie on the Subanuns of Sindangan Bay is at present in press.

A paper by Doctor Saleeby on the Moros has been in preparation since 1907. It is devoted to an account of the religion, languages, customs and habitat of the various tribes which make up the Mohammedan population of Mindanao and adjacent islands. In a fire which destroyed the house of Doctor Saleeby and all its contents, there was lost a large part of the manuscripts on which this account of the Moros was based. However, it is believed that he may still be able to produce a paper which will add much to our knowledge of the Mohammedan people of the Islands.

INVESTIGATIONS IN THE PROVINCES.

Doctor Miller was sent to Nueva Vizcaya in January to accompany Governor Bryant on a trip through the Ilongot country. A considerable portion of the country through which he passed was formerly a part of Isabela Province but it is now included in Nueva Vizcaya. The journey was made with a view to finding out who the people were who occupied the region and to get some idea of their number. Doctor Miller traveled from Dupax in Nueva Vizcaya to Baler on the Pacific Coast and arrived at the latter place on the tenth day out. The trip was made over little-used trails and it was necessary to ford many streams, so travel was therefore slow, not more than 12 or 15 miles a day being covered. The country was found to be very thinly settled and there were few provisions to be obtained. Only a few Ilongots were encountered. It will be a difficult matter to maintain control over a people as scattered as are the Ilongots of this district.

In March of this year Mr. Christie was sent to Zamboanga for the purpose of making collections among the Subanuns of the Zamboanga Peninsula, the Yakan Moros of Basilan, and the Tirurays in the vicinity of Kotobato. Recent letters received from him indicate that he has made a complete collection of Subanun material. He has also secured as much Tiruray material as circumstances and money available would permit.

During the year Mr. Cole, of the Field Museum staff, left with his notes and collections for the United States. He is expected to return to the Islands after he has arranged and described his collections. A few months ago the members of the Bureau were deeply distressed by the news of the murder of Doctor Jones, also of the staff of the Field Museum. Doctor Jones was killed by Ilongots in the Cagayan Valley. He had finished his work among these people and was about to leave for Manila en route to the United States. His death serves to emphasize the risk which one runs in traveling and living among the pagan peoples of the Islands. Our ethnologists, apparently, have been a little overconfident in the past. Already the lives of several valuable men have been sacrificed and it is hoped that greater caution will be exercised in the future.

Mr. S. C. Simms, from the Field Museum, has recently arrived in Manila to take up Doctor Jones's work and to care for the collection which the latter had made. He is at present in the Cagayan Valley.

Mr. John M. Garvan, who has spent several years in the interior of Mindanao in the Agusan Valley, has been temporarily employed and sent to Mindanao to make collections in the Agusan Valley and a careful and detailed study of the Mandaya tribe. This tribe is one of the most isolated and unfriendly in the entire Archipelago. An account of these people should prove interesting and valuable.

THE PHILIPPINE MUSEUM.

During the year work in relation to the Philippine Museum has progressed satisfactorily. The floor and wall cases for the north room of the museum building have been completed and installed. All of the collections from northern Luzon which were formerly on exhibition in the south room have been moved and installed in the new cases in the north room. The south room is now entirely devoted to Mindanao and the north room to northern Luzon. The middle room is occupied by small collections from various parts of the Islands.

Extensive changes have been made in the lower floor of the building in order to make it available for exhibits. The window spaces have been enlarged and new windows put in so that now there is an abundance of light. A metal ceiling has been provided, a concrete floor laid, a new rear door put in and the walls and ceiling painted.

It is planned to use one-half of this lower floor for an exhibit of forest products from the Forestry Bureau. The posts which support the second floor in this section of the building have been covered each with a different kind of wood; the woods have been finished and polished in natural colors and constitute in themselves an interesting exhibit. The forestry exhibit will shortly be installed.

The south half of the lower floor will be devoted to ethnological collections. There are already on hand several museum cases in which these collections may be deposited. Other cases are in progress of construction and when they are completed almost all the available space for cases will be filled.

With the appropriation available for the coming year the Bureau will be in a position greatly to increase the collection and render the museum more valuable.

LIBRARY.

The library has long ago outgrown the space available for it in the present building, and at least 1,200 feet of additional shelf space will be required within a year. It is hoped that arrangements may be completed whereby this very valuable library which it has taken years of labor to acquire, may be installed in fireproof quarters in the new wing of the laboratory to be constructed during the year.

The progress in permanent organization has been more satisfactory than during any previous year. All new material, both bound and unbound, has been classified and shelf-listed as received during the greater part of the year. This method has its advantage in furnishing a considerable amount of classified material in the various sections when taken up in the regular course of work, but the greater the amount of new material added the greater the delay in completing the organization of material already on hand.

Additions.—Bound volumes to the number of 1,339 were added during the past year, 610 by binding, 739 from all other sources. The following list shows some of the more important works and sets of periodicals included in this number:

Bloch. Ichtyologie, 12 volumes.
Siebold. Fauna Japonica, 4 volumes.
Tryon. Manual of Conchology, 17 volumes.
Association of American Physicians. Transactions, 12 volumes.
Australasian Association for the Advancement of Science. Report, 9 volumes.
Geologisches reich-museum, Leyden. Sammlungen, 9 volumes.
Royal Dublin Society. Scientific proceedings, 10 volumes.
Royal Dublin Society. Scientific transactions, 6 volumes.
Royal Society of London. Catalogue of scientific papers, 13 volumes.
Société d'anthropologie, Paris. Bulletins et memoires, 47 volumes.
Archiv für protistenkunde, 11 volumes.
Biometrika, 5 volumes.
Botanische zeitung 60 volumes.
Deutsche entomologische zeitschrift, 15 volumes.
Jahrbücher für wissenschaftliche botanik, 39 volumes.
Journal of Geology, 14 volumes.
Orchid Review, 15 volumes.
Zeitschrift für morphologie und anthropologie, 10 volumes.

The total number of bound volumes accessioned to date is 16,481, costing ₱85,327.38, an average of ₱5.11+ per volume.

CLASSIFICATION AND SHELF-LISTING.

Although the work on permanent organization has been seriously interrupted during the past five months, the results for the entire year are encouraging, 5,326 bound volumes, 6,862 unbound volumes and 950 parts of volumes have been classified and shelf-listed, adding 2,173 cards to the shelf-list. A duplicate copy of the shelf-list with an author index has been placed in the reading room and serves as a classed catalogue. This is now much used not only by the staff of the library, for whom it saves a great deal of time, but by many of the scientific workers of the Bureau as well. It is the intention to withdraw the index cards and substitute catalogue cards as rapidly as possible, so that the alphabetical author index to the shelf-list will be gradually replaced by the permanent dictionary catalogue.

Library of Congress cards.—The proof of all cards printed by the Library of Congress is received regularly, cut, and filed. This affords a reference catalogue of great value to the library. A limited number of cards is ordered from each shipment of proof. These cards are confined to works already in the library and to those which we hope soon to obtain.

List of duplicates.—An accurate record of all duplicate material on hand has been prepared, and as soon as this has been compared with the property records, such duplicates as are found to be available for exchange will be offered for this purpose.

Maps and catalogue.—The map and catalogue records, which during previous years had fallen behind, have been brought up to date. It has not yet been decided whether the present methods of recording these will be continued permanently, but no changes are planned until the classification and cataloguing of all scientific and statistical material in the library has been entirely completed.

Exchanges.—The policy in regard to exchanges with our own publications during the year has been to complete sets of publications already on hand rather than to seek new exchanges. The only new exchanges added have been publications urgently needed by workers of the Bureau and those of a similar character which have requested exchange. The total number of exchanges is now 381.

Use of the library.—The use of the library has remained about the same as during the year ending June 30, 1908, with the difference that a greater amount of reading has been done in the library reading room by the workers of the Bureau. The number of borrowers taking publications from the library has remained practically the same as during the previous year but the number of publications taken out has decreased from 8,135 to 4,899. This is due in large measure to the greater quiet in the reading room. It is hoped during the coming year to reduce the noise still more by removing all typewriters from the reading room. It is also hoped that the library may be brought more prominently before specialists outside of the group of scientific Bureaus of the Government, and its use among interested persons in Manila increased. As soon as the library can be kept open regularly in the evenings this can be accomplished to better advantage.

THE PHILIPPINE JOURNAL OF SCIENCE.

In the report of the previous year the advisability of having the Philippine Journal of Science issued in three sections was pointed out. At present the sections consist of Medical Science, General Science, and Botanical Science. Some complaints have been received during the year in regard to the scope of the section on General Science. The number of original contributions which are now being presented for publication in the Journal has so increased that it would appear advisable to divide the General Science section into three divisions, as follows:

(1) Geology and chemistry; to include fiber work, cement testing, food analysis, and general analysis.

(2) Zoölogy and paleontology, to include fishery research, ornithology, entomology, silk culture, etc.

(3) Ethnology, to include anthropology, historical research, museum work, etc.

The Bureau has continued to publish in book form monographs on ethnological subjects which were too comprehensive and too specifically technical to be placed in the Journal; there has been considerable demand for these publications and many copies have been sold.

It is planned to advertise the Journal among scientific workers and institutions more extensively than has been done heretofore. All advertising matter concerning the Philippine Journal of Science up to May, 1909, was sent out from the library; this included a general circular mailed to about 15,000 individuals and institutions, and circulars concerning the special publications of the Bureau sent to the same list and also to all Army officers and teachers in the Philippine Islands. A special circular letter was sent to a large number of libraries. The present subscription list of the Journal includes a considerable number of libraries, and it was hoped that this number might be greatly increased by special advertising. All advertising work, as well as the exchange department of the Journal, has now been transferred from the library and placed in the hands of Mr. Redmayne, who has been appointed business manager for the Journal.

ENGINEERING AND CONSTRUCTION.

A centrifuge with its 14-horsepower motor has been installed in the vaccine room, two cement-testing machines and one fiber-testing machine erected in the cement laboratory, a silk-reeling machine with its motor set up in the room from which the machine shop was removed, an abrasion machine built in the shop and erected in the assay room, and a photomicrographic apparatus for ultraviolet rays installed in the photographer's department.

The machinery has been transferred from the old shop and erected in the new one. A new carpenter bench has been built and the machinist bench renewed. A circular saw and a forge with blower to be connected to the main transmission shaft which will be erected just outside of the shop, are in course of construction.

The design of a testing machine for paving blocks has been commenced.

A new stable has been built for experiments on horses and also a new operating table has been constructed for experiments on cattle diseases.

Besides the regular work in the machine shop for the Bureau of Science, a large amount of private work and work for other Government bureaus has been performed such as the standardization of weights and measures, repairing of automobiles, etc.

Economy.—A considerable economy in the fuel consumption per brake horsepower and a large decrease of cost to produce one kilowatt-hour have been obtained this year through examination and tests performed on the engines, which resulted in several changes and improvements being made in them. Owing to the large increase of work in the machine shop it will shortly be necessary to procure a new lathe and milling machine tools.

The laboratory space available for all the divisions of the biological laboratory has been much overcrowded during the past two years. During the present year considerable work has been interfered with on this account. The addition of a new wing to the laboratory, for which an appropriation of ₱105,000, has already been made, will obviate this difficulty. It is hoped that its erection may be commenced immediately in order that the present congested state of the laboratory may be relieved as soon as possible.

The construction of a building for silk culture has already been commenced.

THE PHOTOGRAPHER.

During the year an apparatus for preparing photomicrographs with ultraviolet rays has been installed and is being used at the present time in preparing certain photomicrographs for publication. Two new cameras have also been purchased for use of field parties. A large amount of work has been done in cataloging the photographs of the laboratory collection which now numbers 9,600. This collection has taken many years to acquire and probably constitutes the most valuable scientific collection of photographs in the Far East.

The following table shows the work performed by the photographer and his assistants:

Prints made for other bureaus, 5 by 7	8,686
For albums 5 by 7 (13 by 18½ cm.)	1,000
Prints:	
8 by 10	750
4 by 5	240
Arroroy maps, 33 by 18 inches	18
Enlargements:	
11 by 14	40
14 by 17	13
20½ by 23	5
Negatives:	
5 by 7 made in Manila, at Kawa Volcano, Cagayan Province, and during recent trip to the Mountain Province	1,250
8 by 10	93
11 by 14	2
Transparencies:	
8 by 10	13
5 by 7	26
Lantern slides:	
Colored	72
Plain	509
Plates 5 by 7 developed	240
Rolls of films developed	8

Plates furnished other bureaus, 20 dozen 5 by 7.

Mr. Martin accompanied Mr. Ferguson to Kawa Volcano and afterwards traveled up the Cagayan Valley for the purpose of obtaining photographs of the tobacco industry; the expedition lasting five weeks. He also accompanied the Honorable, the Secretary of the Interior, to the Mountain Province in June. On this expedition 600 negatives were made, about half of which were developed in the field.

CLERICAL DIVISION.

In addition to the general supervision of the clerical work, disbursement of cash payments, and the receiving and accounting for the cash income, the chief clerk is required to assist the Director in the general routine and administrative work of the Bureau. Much of this work necessitates familiarity with the scientific character of the routine work in order that it may be done intelligently.

During the year all the correspondence and many of the records of the Bureau have been filed under a new system which has been put in operation by Mr. Nell, and owing to this arrangement the work in the Bureau has been much facilitated.

The promptness with which statements have been furnished upon request from the Auditor's Office during the year, has enabled this Bureau to balance its books whenever it was thought desirable; and in this way it has been able to control its expenditures in the most economical manner consistent with efficiency. The quarterly property return to the Auditor has been abolished and in its place a card record of all property has been kept, the Auditor being furnished with a yearly statement showing all property transactions in detail.

The work of recording examinations, analyses, tests, and the handling and recording of the sale of vaccines, serums, supplies, etc., is now well organized. During the year the recording and indexing of all pure food analyses were completed, making a permanent record both for the consultation of the chemists in their future work and for statistical purposes. A complete classification for filing of other chemical examinations and analyses was also made.

There are appended five tables showing in detail the routine work of the Bureau, cash income, appropriation, and expenditures.

Respectfully submitted.

RICHARD P. STRONG,
Chief of the Biological Laboratory,
Acting Director, Bureau of Science.

To the Honorable,
the SECRETARY OF THE INTERIOR, *Manila, P. I.*

Table I.—*Comparative table of routine work performed and supplies manufactured and disposed of during the fiscal year 1909, as compared with the fiscal year 1908, by number or quantity.*

[July 1, 1909.]

Division of the Bureau.	Samples.		Decrease.	Increase.
	1908	**1909**		
Chemical Division:				
Oils, paints, pigments, etc.	103	123		20
Clays, soils, fertilizers, cements	1,357	3,076		1,719
Fuels, gases, petroleums, woods	11	8	3	
Waters	74	99		25
Urines, clinical and toxicological analyses, etc.	403	436		33
Miscellaneous	299	462		163
Total	2,247	4,204		1,957
Pure-food section:				
Foods, alcohols, beverages, etc. (this item includes all samples received at the laboratory during the year; the special report of the pure-food section includes the number completed)	1,057	713	344	
Section of mineral analysis and standardization of weights and measures:				
Assays	575	423	152	
Weights and measures standardized	1,640	5,021		3,381
Calorimetric tests of fuels				
Coal tests	6		6	
Coal analyses	6	7		1
Rocks and minerals	35	8	27	
Metals and alloys	5	3	2	
Total	2,267	5,462		3,195
Biological laboratory:				
Fæces	7,233	7,334		101
Sputum	818	962		144
Blood	1,732	701	1,031	
Gonococci	14,051	14,494		443
Waters	310	169	141	
Necropsies	188	131	57	
Miscellaneous	3,352	3,083	269	
Total	27,684	26,874	810	
Serum section of the biological laboratory:				
Vaccine virus, doses—				
Prepared	3,021,644	2,903,397	118,247	
Disposed of	3,008,945	2,841,391	167,554	
Antirinderpest serum, cc.—				
Prepared	1,900,700	3,678,965		1,778,265
Disposed of	1,887,750	3,652,807		1,765,057
Plague prophylactic, cc.—				
Prepared		3,000		3,000
Disposed of	6,390	750	5,640	
Mallein, doses—				
Prepared	5,828	2,132	3,696	
Disposed of	5,394	2,320	3,074	
Diphtheria antitoxin, units—				
Prepared	719,500	119,000	600,500	
Disposed of	647,000	223,000	422,000	
Tetanus antitoxin, units—				
Prepared	64,000	220,000		156,000
Disposed of	391,850	77,000	314,850	

Table I.—*Comparative table of routine work performed, etc.*—Continued.

Division of the Bureau.	Samples.		De-crease.	Increase.
	1908	1909		
Serum section of the biological laboratory—Continued.				
Cholera prophylactic, cc.—				
Prepared				
Disposed of	30	4	26	
Antiplague serum, cc.—				
Prepared	1,470		1,470	
Disposed of	6,120		6,120	
Anticholera serum, cc.—				
Prepared	1,980	4,789		2,809
Disposed of	1,620	331	1,289	
Antidysentery serum, cc.—				
Prepared	2,250		2,250	
Disposed of	210	270		60
Antityphoid serum, cc.—				
Prepared	450		450	
Disposed of	120	180		60
Anthrax prophylactic No. 1 and No. 2 cc.—				
Prepared	3,947		3,947	
Disposed of	160		160	
Tuberculin, human, cc.—				
Prepared	113		113	
Disposed of	5	109		104
Tuberculin, bovine, cc.—				
Prepared	116	37	79	
Disposed of	3	56		53
Antigonococcus prophylactic, cc.—				
Prepared	390	48	342	
Disposed of	1	102		101
Antistaphylococcus prophylactic, aureus and albus, cc.—				
Prepared	450		450	
Disposed of	2	20		18
Typhoid reagent (for diagnosis), cc.—				
Prepared	65		65	
Disposed of				
Cholera reagent (for diagnosis), cc.—				
Prepared	150		150	
Disposed of				
Normal horse serum, cc.—				
Prepared	11,640	7,150	4,490	
Disposed of	1,840	10,090		8,250
Normal ox serum, cc.—				
Prepared	2,910		2,910	
Disposed of	130	2,340		2,210
Normal carabao serum, cc.—				
Prepared	900		900	
Disposed of		90		90
Normal salt solution, liters.—				
Prepared		1,974		1,974
Disposed of		1,871		1,871
Miscellaneous:				
Shop orders	160	209		49
Photographs	6,694	6,786		3,092
Natural history specimens sold	54			
Miscellaneous work, etc	48	11	91	

TABLE II.—*Comparative table of routine work performed (free and cash) and supplies manufactured and sold during the fiscal year 1909, as compared with the fiscal year 1908, by value.*

[July 1, 1909.]

Division of the Bureau.	1908	1909	Decrease.	Increase.
Chemical division:				
Oils, paints, pigments, etc	₱738.00	₱1,116.60		₱378.60
Clays, soils, fertilizers, cements	16,146.00	15,432.75	₱713.25	
Gases, petroleums, woods, fuels	202.50	75.00	127.50	
Waters	2,535.00	2,725.00		190.00
Urines, clinical and toxicological analyses, etc	1,278.00	1,364.00		86.00
Miscellaneous	5,427.50	4,255.00	1,172.50	
Total	26,327.00	24,968.35	1,358.65	
Pure-food section:				
Foods, alcohols, beverages, etc	17,129.50	10,382.00	6,747.50	
Section of mineral analysis and standardization of weights and measures:				
Assays	2,108.00	1,121.00	987.00	
Weights and measures, standardization	975.40	3,084.40		2,109.00
Calorimetric tests of fuels				
Coal tests	600.00		600.00	
Coal analyses	190.00	145.00	45.00	
Rocks and minerals	317.00	116.50	200.50	
Metals and alloys	22.50	21.00	1.50	
Miscellaneous				
Total	4,212.90	4,487.90		275.00
Biological laboratory:				
Fæces	21,703.00	81,270.00		59,567.00
Sputum	2,451.00	2,884.00		433.00
Blood	5,200.00	2,103.00	3,097.00	
Gonococci	42,153.00	43,482.00		1,329.00
Waters	8,240.00	5,120.00	3,120.00	
Necropsies	4,700.00	3,275.00	1,425.00	
Miscellaneous	12,795.00	10,969.00	1,826.00	
Total	97,242.00	149,103.00		51,861.00
Serum section of the biological laboratory:				
Vaccine virus	30,117.60	29,136.30	981.30	
Antirinderpest serum, bottling, standardizing, etc., only	6,695.45	10,955.43		4,259.98
Mallein	5,314.00	2,220.50	3,093.50	
Miscellaneous preparations	825.85	1,205.35		379.50
Total	42,952.90	43,517.58		564.68
Miscellaneous:				
Shop work exclusive of work done for this Bureau		67.22		67.22
Photographic work	2,305.50	3,072.98		767.48
Natural history specimens sold	19.00			
Miscellaneous work, etc	2,137.43	1,683.30	473.13	
Supplies		3,210.27		3,210.27
Sale of publications (cash only)		1,780.00		1,780.00
Total	4,461.93	9.813.77		5,351.84
Grand total	192,326.23	242,272.60		49,946.37

TABLE III.—*Comparative table of cash receipts for the fiscal year 1909, as compared with the fiscal year 1908.*

[July 1, 1909.]

Division of the Bureau.	**1908**	**1909**	Decrease.	Increase.
Chemical laboratory:				
Oils, paints, pigments, etc	₱283.10	₱106.50	₱176.60	
Clays, soils, fertilizers, cements	8,243.00	3,895.75	4,347.25	
Gases, petroleums, woods, fuels	25.00	39.00		₱14.00
Waters	505.00	535.00		30.00
Urines, clinical and toxicological analyses, etc	238.00	175.00	63.00	
Miscellaneous	213.00	1,120.50		907.50
Total	9,507.10	5,871.75	3,635.35	
Pure-food section:				
Foods, alcohols, beverages, etc	513.50	772.00		258.50
Section of mineral analysis and standardization of weights and measures:				
Assays	2,096.00	930.00	1,166.00	
Weights and measures standardization	30.00		30.00	
Calorimetric tests of fuel				
Coal tests	200.00		200.00	
Coal analyses	190.00	70.00	120.00	
Rocks and minerals	242.00	17.50	224.50	
Metals and alloys	13.50		13.50	
Miscellaneous				
Total	2,771.50	1,017.50	1,754.00	
Biological laboratory:				
Fæces	96.00	78.00	18.00	
Sputum	36.00	60.00		24.00
Blood	24.00	48.00		24.00
Gonococci	9.00	18.00		9.00
Waters	210.00	205.00	5.00	
Necropsies				
Miscellaneous	127.00	105.00	22.00	
Total	502.00	514.00		12.00
Serum section of the Biological laboratory:				
Vaccine virus	30,117.60	29,136.30	981.30	
Antirinderpest serum, bottling, standardizing, etc. only	6,695.45	10,955.43		4,259.98
Mallein	5,514.00	2,220.50	3,093.50	
Miscellaneous preparations	825.85	1,205.35		379.50
	42,952.90	43,517.58		564.68
Miscellaneous:				
Shop work	118.58	67.22	51.36	
Photographic work	1,999.14	2,513.58		514.44
Natural history specimens	19.00			
Miscellaneous work, etc	2,806.29	2,739.80	85.49	
Supplies	2,137.43	3,210.27		1,072.84
Sale of documents		1,780.00		1,780.00
Refunds, work not done, etc. (deducted)		356.45	356.45	
Total	7,080.44	9,954.42		2,873.98
Grand total	63,327.44	61,647.25	1,680.19	

TABLE IV.—*Showing free and cash work performed and supplies sold to the various Departments of the Government for the fiscal year 1909.*

[Value of free work estimated in accordance with Act No. 807, section 1, Bureau of Government Laboratories, last paragraph.—July 1, 1909.]

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of health:				
Foods, alcohols, beverages	613	₱9,081.00		
Urines, clinical and toxicological analyses, etc	386	1,117.00		
Miscellaneous chemical analysis and examinations	48	1,375.00		
Waters—				
Chemical	30	735.00		
Biological	134	3,895.00		
Fæces	2,308	42,424.00		
Sputum	194	580.00		
Blood	682	2,046.00		
Gonococci	14,488	43,464.00		
Necropsies	123	3,075.00		
Miscellaneous biological work and examinations	3,062	10,677.00		
Vaccine virus	2,793,104		₱27,931.04	
Miscellaneous serums and preparations			469.98	
Photographic work	74		23.10	
Shopwork	3		5.11	
Supplies			175.22	
Total		118,469.00	28,604.45	₱147,073.45
Bureau of Agriculture:				
Fertilizers, cements, clays, soils	1	4.00		
Fuel, woods, gases, petroleums	3	30.00		
Foods, alcohols, beverages	3	35.00		
Urines, clinical and toxicological analyses, etc	1	3.00		
Miscellaneous chemical work and examinations	4	50.00		
Waters, biological	1	40.00		
Miscellaneous biological work and examinations	13	142.00		
Anti-rinderpest serum (bottling, sterilizing, etc. only)	3,652,807		10,955.43	
Mallein	85		8.50	
Miscellaneous serums and preparations			4.00	
Photographic work	248		67.60	
Supplies			288.51	
Total		304.00	11,324.04	11,628.04
Bureau of Supply:				
Oils, paints, pigments, etc	65	675.00		
Fertilizers, cements, clays, soils	12	1.00	22.00	
Foods, alcohols, beverages	1	15.00		
Standardization of weights and measures	5,009	2,028.00	997.00	
Miscellaneous chemical work and examinations	1	10.00		
Waters, chemical	16	240.00		

TABLE IV.—*Showing free and cash work performed, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Supply—Continued.				
Miscellaneous biological work and examinations	1	₱15.00		
Supplies			₱123.01	
Total		2,984.00	1,142.01	₱4,126.01
Bureau of Public Works:				
Oils, paints, pigments, etc	3	35.00		
Fertilizers, cements, clays, soils	2,732	10,067.00	1,820.00	
Miscellaneous chemical work and examinations	5	73.50		
Waters—				
Chemical	21	805.00		
Biological	19	760.00		
Supplies			286.34	
Total		11,740.50	2,106.34	13,846.84
Bureau of Prisons:				
Fertilizers, cements, clays, soils	8	240.00		
Standardization of weights and measures	2	16.00		
Waters, biological	4	100.00		
Fæces	5,054	38,768.00		
Sputum	748	2,244.00		
Blood	3	9.00		
Necropsies	8	200.00		
Miscellaneous biological work and examinations	1	10.00		
Photographic work	167		49.80	
Total		41,587.00	49.80	41,636.80
Bureau of Internal Revenue:				
Foods, alcohols, beverages	31	394.00		
Standardization of weights and measures	2		1.40	
Miscellaneous chemical work and examinations	74	453.00		
Supplies			14.65	
Shop work			9.68	
Total		847.00	25.73	872.73
Bureau of Printing:				
Miscellaneous chemical work and examinations	69	690.00		
Waters—				
Chemical	1	40.00		
Biological	1	40.00		
Photographic work	2		7.00	
Supplies			22.00	
Total		770.00	29.00	799.00
Bureau of Customs:				
Oils, paints, pigments, etc	23	240.00		
Foods, alcohols, beverages	10	126.00		
Standardization of weights and measures	1	8.00		
Metals and alloys	3	21.00		

TABLE IV.—*Showing free and cash work performed, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Customs—Continued.				
Miscellaneous chemical work and examinations	37	₱308.00		
Waters, chemical	1	15.00		
Total		718.00		₱718.00
Bureau of Science:				
Oils, paints, pigments, etc	1	10.00		
Fertilizers, cements, clays, soils	42	905.00		
Fuels, woods, gases, petroleums	2	6.00		
Foods, alcohols, beverages	5	25.00		
Urines, clinical and toxicological analyses, etc	1	3.00		
Rocks and minerals	7	99.00		
Coal analyses	5	75.00		
Assays	66	191.00		
Miscellaneous chemical work and analyses	8	110.00		
Waters—				
Chemical	7	340.00		
Biological	1	40.00		
Photographic work	969	559.40		
Shopwork (not estimated)	196			
Miscellaneous		356.45		
Total		2,719.85		2,719.85
Bureau of Justice:				
Miscellaneous chemical work and examinations	1		₱5.00	
Miscellaneous biological work and examinations	1		75.00	
Total			80.00	80.00
Bureau of Forestry:				
Photographic work	162		65.10	65.10
City of Manila:				
Fertilizers, clays, cements, soils	215		1,550.00	
Foods, alcohols, beverages	2		108.00	
Urines, clinical and toxicological analyses, etc	1		10.00	
Waters—				
Chemical	4		65.00	
Biological	4		45.00	
Miscellaneous serums and preparations			61.50	
Total			1,839.50	1,839.50
Provinces and municipalities:				
Waters—				
Chemical	5		75.00	
Biological	1		40.00	
Vaccine virus	10,000		300.00	
Miscellaneous serums and preparations			6.00	
Total			421.00	421.00

TABLE IV.—*Showing free and cash work performed, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Public Health and Marine Hospital Service:				
Vaccine virus	6,800		₱68.00	₱68.00
Executive Bureau:				
Photographic work	4		18.50	18.50
Bureau of Lands:				
Miscellaneous work and supplies	1		1.00	1.00
Philippine Medical School:				
Miscellaneous serums and preparations			1.00	
Photographic work	214		98.20	
Shopwork	1		10.35	
Supplies			148.54	
Total			258.09	258.09
United States Army and Navy:				
Fertilizers, cements, clays, soils	1		25.00	
Fuels, woods, gases, petroleums	2		14.00	
Foods, alcohols, beverages	5		30.00	
Waters—				
Chemical	3		120.00	
Biological	3		120.00	
Vaccine virus	27,880		825.10	
Mallein	2,212		2,212.00	
Miscellaneous serums and preparations			118.00	
Photographic work	10		20.00	
Supplies			212.00	
Total			3,696.10	3,696.10
Bureau of Education:				
Photographic work	197		158.71	
Supplies			1.50	
Total			160.21	160.21
Bureau of Constabulary:				
Miscellaneous chemical work and examinations	10	₱30.00		
Sputum	2	6.00		
Vaccine virus	1,600		16.00	
Total		36.00	16.00	52.00
Bureau of Navigation:				
Oils, paints, pigments, etc	5	50.00		
Fertilizers, cements, clays, soils	21	310.00		
Waters—				
Chemical	1	15.00		
Biological	1	40.00		
Photographic work	1		1.40	
Total		415.00	1.40	416.40
Philippine Assembly: Photographic work	4		4.80	4.80
Bureau of Audits: Miscellaneous chemical work and examinations	1	15.00		15.00

TABLE IV.—*Showing free and cash work performed, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Miscellaneous:				
Oils, paints, pigments, etc	26		₱111.50	
Fertilizers, cements, clays, soils	44		483.75	
Fuels, woods, gases, petroleums	1		25.00	
Foods, alcohols, beverages	43		634.00	
Urines, clinical and toxicological analyses, etc	47		165.00	
Rocks and minerals	1		17.50	
Coal analyses	2		70.00	
Assays	357		930.00	
Standardization of weights and measures	7		34.00	
Miscellaneous chemical work and examinations	204		1,115.50	
Waters, chemical	10		275.00	
Faeces	26		78.00	
Sputum	18		54.00	
Blood	16		48.00	
Gonococci	6		18.00	
Miscellaneous biological work and examinations	5	₱20.00	30.00	
Vaccine virus	2,007		92.20	
Mallein	23		23.00	
Miscellaneous serums and preparations			462.70	
Photographic work	7,734		1,999.37	
Shopwork	8		42.08	
Supplies			1,174.05	
Miscellaneous work, etc.			2,429.98	
Sale of publications			1,780.00	
Refunds, work not done, etc. (deductions)			356.45	
Total		20.00	11,736.18	₱11,756.18
Grand total		180,625.35	61,647.25	242,272.60

TABLE V.—*Comparative statement showing expenditures (including obligations incurred) for the fiscal year 1909 as compared with the fiscal year 1908.*

[July 1, 1909.]

Item.	Expended during the year.	Outstanding obligations at July 1, 1909, incurred during the fiscal year.	Total for the fiscal year 1909.	Total for the fiscal year 1908.	Decrease.	Increase.
Apparatus, supplies, etc.:						
Miscellaneous supplies and chemicals	₱31, 337. 08	₱6, 245. 66	₱19, 782. 74	₱41, 035. 01	₱8, 837. 01	
Apparatus	4, 690. 39	7, 724. 87	12, 415. 26			
Supplies for power plant, oil, coal, etc	8, 865. 17	42. 49	8, 907. 66	15, 584. 55	6, 676. 89	
Small animals, feed, etc	4, 757. 94		4, 757. 94	2, 218. 51		₱2, 539. 43
Large animals, feed, etc	6, 508. 41	200. 00	6, 708. 41	4, 731. 75		1, 976. 66
Office supplies	2, 514. 52	24. 96	2, 539. 48	2, 234. 04		305. 44
Photographic supplies	3, 104. 33	18. 20	3, 122. 53	3, 364. 60	242. 07	
Books, subscriptions, etc	687. 21	[a] 7, 075. 82	7, 763. 03	11, 187. 01	3, 423. 98	
Total	44, 665. 05	21, 332. 00	65, 997. 05	80, 355. 47	14, 358. 42	
Transportation and freight:						
Transportation, travel expenses, per diems, launch hire, etc	10, 539. 60	1, 070. 80	11, 610. 40	11, 931. 45		268. 85
Freight	539. 90	50. 00	589. 90			
City transportation	5, 403. 35		5, 403. 35	3, 836. 77		2, 066. 58
Total	16, 482. 85	1, 120. 80	17. 603. 65	15, 268. 22		2, 335. 43
Miscellaneous:						
Telephones and fire-alarm boxes	696. 00		696. 00	496. 60		199. 40
Postage, telegrams, cablegrams	2, 492. 88		2, 492. 88	2, 399. 78		93. 10
Repairs to apparatus, furniture, etc	602. 26		602. 26	1, 301. 31	699. 05	
Laundry	409. 99		409. 99	246. 77		163. 22
Printing and binding	17, 296. 36	5, 153. 80	22, 450. 16	25, 190. 47	2, 740. 31	
Advertising	750. 00		750. 00	216. 08		533. 92
Incidentals, building maintenance, etc	1, 970. 79	2, 622. 50	4, 593. 29	24, 576. 70	19, 983. 41	
Total	24, 218. 28	7, 776. 30	31, 994. 58	54, 427. 71	22, 433. 13	

TABLE V.—*Comparative statement showing expenditures, etc.*—Continued.

Item.	Expended during the year.	Outstanding obligations at July 1, 1909, incurred during the fiscal year.	Total for the fiscal year 1909.	Total for the fiscal year 1908.	Decrease.	Increase.
Salaries and wages:						
Salaries and wages	₱32,392.72	₱664.18	₱233,056.90	₱199,259.89		₱33,797.01
Transportation en route foreign country to Manila and expenses	2,157.50		2,157.50	13,727.29		4,229.28
Accrued leave and half salary	15,799.07		15,799.07			
Total	250,349.29	664.18	251,013.47	212,987.18		38,026.29
Grand total	335,715.47	[a]30,893.28	366,608.75	[b]363,038.58		3,570.17
The outstanding obligations on the fiscal year 1908 unpaid at July 1, 1908, amounted to ₱86,285.55. During the fiscal year 1909 the following sums were paid off against this amount: ₱59,437.28 in cash payments; ₱2,285.96 difference between actual and estimate; ₱3,550.73 canceled and reordered in fiscal year 1909; and ₱15,257.13 charged back to the fiscal year 1908; a total of ₱80,531.10, leaving the obligations still due on the fiscal year 1908 ₱5,754.45	59,437.28	5,754.45				
Total	395,152.75	[a]36,647.73				

Appropriation account:	
Appropriated Act 1873	307,814.00
Cash receipts	61,647.25
Restored from balance of the previous year to meet outstanding obligations of the fiscal year 1908	59,478.49
Total	428,939.74
Expended as shown above ₱395,152.75 plus outstanding obligations ₱33,786.99 (₱36,647.73 minus the special Library Fund ₱2,860.74)	428,939.74
Library fund	2,909.00
Outstanding obligations	2,860.74
Balance	48.26

---

[a] Includes 2,860.74 ordered against the library fund, making the total outstanding obligations ₱33,786.99.

[b] This item of ₱363,038.58 plus ₱39,869.18, outstanding obligations of the previous year, equals a total expended during the fiscal year 1908 of ₱402,907.76. Subtracting from this sum the outstanding obligations of ₱86,285.55 we have the cash expenditure of ₱316,622.21 as shown in the Report of the Auditor for the Philippine Islands, fiscal year 1908, Part I, page 79.

INDEX.

Analyses, water, bacteriological, 16; chemical, 32; of food and drugs, 36; of rocks and minerals, 34; water, 16.
Animal diseases, investigation of, 7.
Animal parasites, infection with in Bilibid Prison, 11; infection with among women and children, 15; infection with in town of Taytay, 11.
Artesian well waters, examination of, 16, 32.
Biological laboratory, 1; bacterial vaccines, preparation of, 18; botanical section, 24; centrifugal machine, installation of, 17; entomological section, 21; examinations of human blood, 16, 17; medical section, 1; miscellaneous products, 18; publications and investigation of, 16; relation of Philippine Medical School and Hospital to, 6; routine work, 16; securing of trained men for, 5; serum section of, 17; staff of, 1; vaccine virus, 13; zoölogical section, 18.
Botanic Garden, need of, 29.
Botanical section, 24; economic work of 24; exchanges, 27; publications of, 25; systematic work of, 25.
Cement, increase in value of work in, 32; investigations in, 30.
Chemical laboratory, 29, 32; cement, investigations in, 30, 32; copal, Manila, 31; paper pulp, investigations in, 30; 678 publications of, 29, 34; recommendations for future work of, 30; routine work of, 31; sugar, investigations in, 30.
Cholera, work of biological laboratory with Bureau of Health in combating epidemic of 1908, 13; advance in bacteriologic diagnosis of cases of, 13; examination of Manila water supply during epidemic of, 14; laboratory investigations in study of, 14.
Cholera vibrio carriers, 13.
Clays, continuation of work in, 34, 35.
Clerical division, 48.
Coals, practical utilization of Philippine, 35; publications on, 35.
Cobras, number of in Philippines, 20; three new species, 20.
Copal, Manila, 31.
Diphtheria, epidemic of in Manila, 14.
Diseases, animal, 7; hydrophobia, 8; piroplasmosis, 7, 8; surra, 8.
Diseases in the provinces, study of, 9.
Dysentery, bacillary, 10; study of in Batangas, 12.
Engineering and construction, 46; economy in, 46; installation of 14-horsepower centrifuge in vaccine room, 46; new stable for horses, 46; other work, 46.
Entomological section, 21; accessions to, 21; donations, 21; identification of materials, 21; routine determinations, 22.
Ethnology, division of, 41; investigations in provinces, 42; publications of, 41.
Fish and fisheries, 18; additions to number of species, 19; study of fauna of Bantayan reef, 18.
Fishes, commercial, 19.
Food and drugs, number of analyses of during year, 36; publications of, 37; research work in, 37; summary of analysis of, 38; violation of Food and Drugs Law, 36.
Gandara Valley, investigations in, 14.
Gas plant, 35, 36.
Helminthological collection, additions to, 15.
Helminthologist, 4.
Herbarium, the, 27; accessions to, 27.
Hydrophobia, 8.
Igorots, publications on, 41.
Insect pests, injurious to trees, study of, 24; need of forest entomologist, 24.
Invertebrates, marine, 20.
Investigations of biological laboratory, 14; of botanical section, 24, 25; of chemical division, 29, 34; of division of ethnology, 41; of entomological section, 21; of food and drugs, 37; of division of mines, 38, 39; of ornithological section, 20; of division of weights and measures, 32.
Jones, Dr., murder of, 42.
Journal of Science, Philippine, advertising of among scientific workers, 46; recommendations for division of section on general science, 45.
Leprosy bacillus, cultivation of, 12.
Leprosy in the provinces, 12; cultivation of the leprosy bacillus, 12.
Library, 43; additions to, 43; classification and shelf listing, 44; exchanges, 45; Library of Congress cards, 44; maps and catalogues, 45; need of fireproof quarters for, 43; progress in permanent organization of, 43; use of, 45.
Mandaya tribe, study of, 42.

Medical zoölogical work, 15; discovery of new intestinal trematode, 15; studies concerning prevalence of intestinal parasites in Philipines, 15.
Mineral springs, examination of waters of, 32.
Mines, division of, 38; branch mint, 40; examinations of structural materials, 39; field work of, 38; improvement in mining industry, 41; machine for abrasion tests, construction of, 39; testing plant, 40; publications of, 40; staff of, 38.
Mint, need of branch in Philippines, 40.
Moros, publications on, 41, 42.
Mosquitoes, biology of, 21; supression of, 24.
Museum, Philippine, progress of work in, 43; changes in building, 43; need of more cases for, 20.
New hospital, relation of biological staff to, 6.
Ore-testing plant, need of, 40; cost of, 40.
Ornithology, papers on, 20; field work in, 20.
Paper pulp and paper investigations, 30.
Paragonimiasis, 12.
Philippine Medical School, staff of in relation to staff of biological laboratory, 6.
Photography, work in during the year, 47.
Piroplasmosis in Philippine cattle, 7, 8.
Pottery, establishment of school of fine, 41; coöperation of Bureau of Education, 41.
Protozoölogist, 4.
Reptiles, additions to collection of, 20.
Resins, Philippine, 30, 31.
Rinderpest, etiology of, 18.
Scientific visitors, 7.
Silkworm culture, success of in Philippines, 23; installation of silk-reeling machine in laboratory, 23.
Silkworms, diseases of, 23; hybridization of "Eri," 23.
Sponge fisheries of Cebu, 19.
Sponges, artificial propagation of, 19; demand for, 19; identification of commercial, 19; regulations governing gathering of in waters of Moro Province, 19.
Structural materials, 39.
Sugar investigations, 30.
Surra, experiments in treatment of, 8.
Tables, 49, 59.
Taytay, investigations carried on at, 9.
Termites, thorough study of Philippine, 24.
Texas fever, 7.
Trypanosomiasis, relation to piroplasmosis, 8.
Tuff, Philippine volcanic, 34.
Waters, number of examined, 32; bacteriological, 16; chemical, 32.
Weights and measures, standardization of number tested, 32, 33; manufactured by Bureau of Science, 33.
Zoölogical section, 18.

○

[illegible]

[illegible] 25 [illegible]

UNIVERSITY OF MICHIGAN
3 9015 04878 4451

BOOK CARD

Q
183
.P55

AUTHOR Phillipine Bur. of Science

TITLE Reports V. 5-11.

1906-12

SIGNATURE	ISS'D	RET'D

Form 176(8-22-21)30M

PHILIPPINE
BUREAU
OF
SCIENCE

REPORTS
5-11
1906-12

Q
183
.P55

UNIV.
OF
MICH.